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NORTHERN AIRBORNE TECHNOLOGY LTD.

Evaluation of an EPIRB with an Integrated GPS Receiver

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Evaluation of an EPIRB with an Integrated GPS Receiver

by
W. Street
Northern Airborne Technology Ltd.

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16. Abstract

This report details the various field trials conducted on a previously developed prototype Emergency Position Indicating Radio Beacon (EPIRB) with an integrated Global Positioning System (GPS) receiver, and outlines the results of those field trials. Three field trial phases consisted of Dry Land Tests, Lake Tests, and Sea Tests. A modified EPIRB was tested to verify the successful reception of GPS satellite signals and to verify that location data was included in the 406 MHz message transmitted by the EPIRB. An unmodified EPIRB was tested to verify that location data can be transmitted to both the Cospas-Sarsat satellites and the geostationary satellites. The results of these tests proved that the GPS-EPIRB can determine its own location using the integrated GPS receiver and transmit this position in the message of the 406 MHz signal. It was also successfully demonstrated that the geostationary satellites can receive a near-instantaneous alert with location data. With this information, Search and Rescue (SAR) forces will be able to respond faster and have a much smaller search area. This will save money and, more importantly, save more lives.

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16. Résumé

Ce rapport rend compte des essais en vraie grandeur d'un prototype de radiobalise de localisation de sinistres (EPIRB, *Emergency Position Indicating Radio Beacon*) à récepteur GPS intégré, développé dans une phase antérieure. Les essais ont eu lieu sur la terre ferme, sur lac et en mer. Un EPIRB modifié a également été mis à l'essai afin de vérifier si les satellites GPS recevaient bien les signaux et si le message émis sur 406 MHz comprenait bien les données de position. Les essais de l'EPIRB non modifié voulaient vérifier si les données de position pouvaient être transmises autant aux satellites du système COSPAS-SARSAT qu'aux satellites géostationnaires. Les essais ont confirmé l'aptitude de l'EPIRB à GPS intégré de déterminer sa position et de communiquer celle-ci sur 406 MHz. Il a également été démontré que les satellites géostationnaires peuvent recevoir un signal de détresse quasi instantané, en même temps que des données de position. Grâce à cette information, les équipes de recherche et sauvetage (SAR) pourront intervenir plus rapidement et dans une zone beaucoup mieux circonscrite, ce qui permettra d'économiser les ressources et, plus important encore, de sauver plus de vies.

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EXECUTIVE SUMMARY

This project is the logical conclusion to several previous initiatives sponsored by the National Search and Rescue Secretariat New SAR Initiatives Program. These initiatives include two Industry Canada, Communications Research Centre projects for the design and development of 406 MHz Personal Locator Beacons, as well as Transport Canada, Transportation Development Centre projects for the design and development of a 121.5/406 MHz Emergency Position Indicating Radio Beacon (EPIRB) and an EPIRB with an integrated Global Positioning System (GPS) receiver. This project details the testing, evaluation, and certification of the GPS-EPIRB.

The field trials included the Kelowna and West Coast Trials, the Newfoundland Trials, and the Department of National Defence (DND) Northern Field Trials. The Kelowna and West Coast Trials consisted of Dry Land Tests, Lake Tests, and Sea Tests. The Dry Land Tests were conducted on the roof of Northern Airborne Technology in Kelowna in order to determine the GPS acquisition characteristics for a GPS-EPIRB mounted in a ground plane to simulate the unit floating in water. These tests were successful even when the ground plane was rocked to simulate wave action. The GPS signal was acquired and maintained, and the location data was successfully included in the 406 MHz signal and received using a hand-held tester.

The Lake Tests involved deploying two GPS-EPIRBs in a calm-water environment. One EPIRB was modified by replacing the 406 MHz antenna with a coaxial cable to monitor the information contained in the 406 MHz message. The second unit was unmodified and transmitted signals to the Cospas-Sarsat satellites and the geostationary satellites. The data from the modified unit showed that the GPS location data was successfully included in the 406 MHz message. The data collected by the Canadian Mission Control Centre (CMCC) for the unmodified unit showed that the signal with location data was received by the geostationary satellites 2 minutes and 34 seconds after activation with a location accuracy of 318 m. The time for the first Cospas-Sarsat satellite to receive data was 1 hour and 27 minutes, yielding a Doppler location accuracy between 2.7 km and 3.8 km.

The Sea Tests were conducted in a similar format as the Lake Tests except the location was on the ocean with sea levels at about 1 to 2 m. The first transmission was received by the geostationary satellite 1 minute and

31 seconds after activation. This message lacked location data. The first message with location data was received in 4 minutes and 12 seconds with a location accuracy of 138 m. The first Doppler location from the Cospas-Sarsat satellites occurred at 1 hour and 33 minutes. The location accuracy of this and subsequent satellite passes ranged from 580 m to 5120 m. This is typical.

These tests proved that using an EPIRB with an integrated GPS receiver can produce a near-instantaneous alert with location data, which will result in a significantly reduced search area and thus help save more lives as well as minimize Search and Rescue (SAR) resource time. This is a major step in the effort to increase the likelihood of survival by decreasing the alerting time as well as the time and cost of the SAR mission.

The full MPR Teltech report of the Newfoundland Trials conducted on the GPS-EPIRB is included as an appendix. A brief report on the DND Northern Field Trials is also included as an appendix. Other appendices include photographs of the Kelowna and West Coast Trials, data from the CMCC, and the GPS-EPIRB Field Trial Test Plan.

Subsequent to this project, the GPS-EPIRB was modified for production, type-approved, and launched as the SATFIND-406 GPIRB™. The GPIRB was the first fully approved beacon with an integrated GPS receiver. In its first year, the GPIRB received two prestigious international awards: SAIL magazine's Freeman K. Pittman Award and the Seatrade Award in the Safety at Sea category.

SOMMAIRE

Ce projet représente l'aboutissement logique d'un programme de recherche et développement de longue haleine coparrainé par le Fonds de nouvelles initiatives de recherche et de sauvetage du Secrétariat national, Recherche et sauvetage. Parmi les faits saillants de ce programme de R&D figurent deux projets du Centre de recherches sur les communications d'Industrie Canada, qui visaient la conception et le développement de radiobalises portatives, ainsi que des recherches pilotées par le Centre de développement des transports de Transports Canada visant la conception et le développement d'une radiobalise de localisation de sinistres (EPIRB) émettant sur 121,5/406 MHz, et d'un EPIRB à récepteur GPS intégré. Le présent projet comportait l'essai, l'évaluation et l'homologation de l'EPIRB-GPS.

Les essais en vraie grandeur se sont déroulés à Kelowna et sur la côte Ouest, à Terre-Neuve et sur une base du Nord du ministère de la Défense nationale (MND). Les essais de Kelowna et de la côte Ouest effectués sur la terre ferme (sur le toit de l'immeuble de Northern Airborne Technology à Kelowna) avaient pour objet de déterminer les caractéristiques d'acquisition des données GPS émises par un EPIRB à GPS intégré monté sur une plaque de masse simulant une embarcation flottant sur l'eau. Ces essais se sont révélés fructueux, même lorsqu'on faisait osciller la plaque de masse pour simuler l'effet des vagues. Le signal GPS était reçu et entretenu, et les données de position étaient comprises dans le signal émis sur 406 MHz et reçu à l'aide d'un appareil d'essai à main.

Les essais sur lac consistaient à déployer deux EPIRB-GPS dans des eaux calmes. Sur une des radiobalises, l'antenne 406 MHz avait été remplacée par un câble coaxial, qui permettait de contrôler l'information contenue dans le signal émis sur 406 MHz. L'autre radiobalise, non modifiée, émettait vers les satellites du système COSPAS-SARSAT et vers les satellites géostationnaires. Le message émis sur 406 MHz par la radiobalise modifiée contenait effectivement les données de position GPS. Selon l'information recueillie par le Centre canadien de contrôle des missions (CCCM), les signaux contenant les données de position émis par la radiobalise non modifiée étaient captés par les satellites géostationnaires 2 min 34 s après l'activation de la radiobalise, et la localisation était précise à 318 m près. La première captation par un satellite du système COSPAS-SARSAT a eu lieu au bout de 1 h 27 min, et la localisation, compte tenu de l'effet Doppler, était précise à 2,7 – 3,8 km près.

Les essais en mer suivaient un protocole similaire à celui des essais en eaux calmes. Ils ont eu lieu dans l'océan, au milieu de vagues de 1 à 2 m. La première transmission a été reçue par le satellite géostationnaire 1 min 31 s après l'activation de la radiobalise. Mais ce message ne contenait pas les données de position. Le premier message contenant les données de position a été reçu en 4 min 12 s et le positionnement était précis à 138 m près. La première localisation tenant compte de l'effet Doppler effectuée par un satellite du système COSPAS-SARSAT a été reçue au bout de 1 h 33 min. Cette localisation et les localisations effectuées lors des passages subséquents des satellites étaient précises à 580 - 5120 m près, ce qui représente la marge d'erreur habituelle.

Les essais effectués ont confirmé l'aptitude de la radiobalise à récepteur GPS intégré à transmettre une alerte quasi instantanée en même temps que des données de position, permettant de beaucoup mieux circonscrire le secteur de recherche et d'ainsi sauver plus de vies en réduisant la durée des opérations de recherche-sauvetage. Il s'agit là d'une étape majeure dans les efforts pour accroître le taux de survie en diminuant le délai d'alerte, et pour réduire la durée et le coût des missions SAR.

Le rapport complet des essais de la radiobalise réalisés à Terre-Neuve par MPR Teltech figure en annexe, de même qu'un rapport succinct des essais menés par le MDN dans le Nord. Dans les autres annexes sont présentés des photographies des essais de Kelowna et de la côte Ouest, des données du CCCM et le plan des essais en vraie grandeur de l'EPIRB-GPS.

À la suite de ce projet, le GPS-EPIRB a été modifié pour une production en série, il a subi les essais d'homologation et il a été commercialisé sous le nom de SATFIND-406 GPIRB^{MD}. Le GPIRB est la première radiobalise à récepteur GPS intégré à avoir reçu toutes les approbations nécessaires. Dès sa première année sur le marché, le GPIRB a reçu le Prix Freeman K. Pittman 1999 du magazine *Sail*, et le prix *Seatrade* dans la catégorie Sécurité maritime.

TABLE OF CONTENTS

1 INTRODUCTION 1

1.1 Objectives 1
1.1.1 Project Objective 1
1.1.2 R&D Objective 1
1.1.3 R&D Sub-objective 1

1.2 Background 2

1.3 Scope 2

2 FIELD TRIALS 3

2.1 Kelowna and West Coast Trials 3
2.1.1 General 3
2.1.2 Objectives 3
2.1.3 Test Plan 4
2.1.4 Dry Land Tests 4
2.1.5 Lake Tests 8
2.1.6 Sea Tests 10

2.2 Newfoundland Trials 13

2.3 DND Northern Field Trials 13

3 CONCLUSIONS 14

4 ADDENDUM 16

BIBLIOGRAPHY 17

APPENDICES

A Photographs of Kelowna and West Coast Field Trials

B Data from Canadian Mission Control Centre, Trenton

C GPS-EPIRB Field Trial Test Plan

D Report on the Initial Sea Trials of the Prototype GPS-EPIRB Off Newfoundland

E DND Northern Field Trials

LIST OF TABLES

Table 1. Dry Land Tests -Testing Information 5
Table 2. Dry Land Tests - Measured Data 5
Table 3. Dry Land Tests - Decoded Long Message 7
Table 4. Lake Tests -Testing Information 9
Table 5. Lake Tests - Measured Data 9
Table 6. Lake Tests - Decoded Long Message 9
Table 7. Sea Tests - Testing Information 11
Table 8. Sea Tests - 50 Ω Unit Results..... 11
Table 9. Sea Tests - Results from Cospas-Sarsat Satellites 11
Table 10. Sea Tests - Results from GOES 8 and GOES 9 11
Table 11. Sea Tests - Summary of Sequence of Events 12

GLOSSARY

CCG	Canadian Coast Guard
CMCC	Canadian Mission Control Centre
D & E	Demonstration and Evaluation
DGPS	Differential Global Positioning System
DND	Department of National Defence
EEPROM	Electrically Erasable Programmable Read Only Memory
EPIRB	Emergency Position Indicating Radio Beacon
GOES	Geosynchronous Orbiting Environmental Satellite
GPIRB™	Global Position Indicating Radio Beacon
GPS	Global Positioning System
HDOP	Horizontal Dilution of Precision
LEO	Low Earth Orbiting
MCC	Mission Control Centre
SAR	Search and Rescue
TDC	Transportation Development Centre
UIN	Unique Identification Number

1 INTRODUCTION

This document is the final report for the project entitled *Evaluation of an EPIRB with an Integrated GPS Receiver*, sponsored by the Transportation Development Centre (TDC).

1.1 Objectives

The objectives, as set out in the contract's Statement of Work, are as follows:

1.1.1 Project Objective

To test and evaluate a prototype GPS-EPIRB through various trials. These trials include:

- Kelowna and West Coast Trials
- Newfoundland Trials
- Department of National Defence (DND) Northern Trials

1.1.2 R&D Objective

To develop models and systems, and manage experimental trials in support of SAR and other CCG operations seeking improvement in safety and efficiency.

1.1.3 R&D Sub-objective

To develop search planning tools and detection technologies, and conduct validation experiments to reduce search time and improve the efficiency of marine SAR operations.

1.2 Background

Due to the orbitography (low altitude polar orbit) and the number of search and rescue Cospas-Sarsat satellites now in space, a beacon alert message can take anywhere from 30 minutes to 5 hours to be initially detected by the ground station. Typical detection times for Canada average about 2 hours. The integration of a GPS receiver in a 406 MHz Cospas-Sarsat beacon combines location coordinates and a near-instantaneous distress alert. Needless to say, these enhancements would reduce the overall time required to complete a rescue operation.

This project represents the realization of several previous initiatives sponsored by the National Search and Rescue Secretariat New SAR Initiatives Program. These initiatives include two Industry Canada Communications Research Centre projects for the design and development of 406 MHz Personal Locator Beacons (PLBs), as well as Transport Canada TDC projects for the design and development of a 121.5/406 MHz EPIRB and an EPIRB with an integrated GPS receiver. This GPS-EPIRB is unique in the world and permits the encoding of the position coordinates into a 406 MHz beacon's message, providing a near-instantaneous distress alert via geostationary satellite. The GPS-EPIRB prototype is now complete, and evaluation, testing, and certification is required before production units can be built.

1.3 Scope

The scope of the report is to outline the various field-trial tests and present the results of those tests.

2 FIELD TRIALS

2.1 Kelowna and West Coast Trials

2.1.1 General

Two prototype GPS-EPIRBs were used for the field trials. One of the prototype units was modified to substitute a 50Ω coaxial connection in place of the 406 MHz antenna. This allowed for direct monitoring of the 406 MHz transmitter without the signal being transmitted to the satellite. A cable was attached between the GPS/EPIRB interface board and a laptop computer to monitor the data directly from the GPS engine. Testing for this portion of the field trials was completed in accordance with the *GPS-EPIRB Field Trial Test Plan*, which is included as Appendix C. The modified unit is termed the 50Ω Unit, while the second unit is termed the Unmodified Unit.

A selection of photos of the Kelowna and West Coast Trials appears in Appendix A. The raw data obtained from the Canadian Mission Control Centre is listed in Appendix B.

2.1.2 Objectives

The objectives of these field trials were:

- to evaluate the GPS acquisition characteristics while the GPS-EPIRB was mounted on a ground plane at various tilt angles.

- to evaluate the GPS acquisition characteristics while the GPS-EPIRB floated in a calm lake environment, and to observe the correct transmission of the location data on the 406 MHz signal.

- to evaluate the GPS acquisition characteristics while the GPS-EPIRB floated in a sea environment, and to observe the correct transmission of the location data on the 406 MHz signal.

2.1.3 Test Plan

The *GPS-EPIRB Field Trial Test Plan* (see Appendix C) outlines the proper procedure and precautions required for conducting these tests. The tests were divided into three phases: Dry Land Tests, Lake Tests, and Sea Tests.

2.1.4 Dry Land Tests

The Dry Land Tests were conducted on the roof of Northern Airborne Technology in Kelowna, B.C.

2.1.4.1 *Purpose*

To determine how the tilt of the unit will affect GPS satellite acquisition.

To observe the transmission of the location protocol on the 406 MHz signal.

2.1.4.2 *Equipment*

The 50Ω Unit was mounted on a 29-inch diameter aluminum ground plane, which was assembled onto a tilt table. An inclinometer was used to determine the angle of tilt of the ground plane.

A laptop computer was used to download the GPS information and a beacon test set was used to decode the 406 MHz transmission (long message format).

2.1.4.3 Procedure

The unit was activated and, when the GPS was acquired, the location and time were recorded. The GPS location information was then downloaded into the EPIRB's EEPROM. This location information was included in the 406 MHz message using the Cospas-Sarsat Standard

Location Protocol and was transmitted on the next 406 MHz burst. The location information remained in the EEPROM regardless of the information presented by the GPS engine. Updates to the 406 MHz message were done once every hour. The maximum allowable update rate is 20 minutes.

Once the unit had acquired GPS data, the angle of the ground plane was increased incrementally up to 75° to determine whether acquisition would be lost.

The tests were done with the unit facing North, South, East, and West.

2.1.4.4 *Dry land tests results*

Table 1. Dry Land Tests -Testing Information

DATE:	September 16, 1996
TESTED BY:	WS/RB
UIN	279C270008FFBFF
TEST LOCATION COORDINATES:	49°52.75' N, 119°27.40' W

Table 2. Dry Land Tests - Measured Data

AZMTH	TILT	# SATs ACQR'D	ACQT'N (Y OR N)	TIME (UTC)	COORDINATES (LAPTOP)	COORDINATES (BEACON TESTER)
N	0°	3	Y	201436	49°53.04' N, 119°27.61' W	49°53.00' N, 119°27.60' W
	10°	5	Y	202443	49°52.73' N, 119°27.43' W	
	20°	4/5	Y	202627	49°52.73' N, 119°27.46' W	
	30°	4/5	Y	202751	49°52.74' N, 119°27.46' W	
	40°	4/6	Y	202919	49°52.74' N, 119°27.46' W	
	45°	5	Y	203108	49°52.74' N, 119°27.46' W	
	50°	5/3/5	Y	203249	49°52.74' N, 119°27.46' W	
	55°	3/0/5	Y/N/Y	203541	49°52.74' N, 119°27.46' W	
	60°	3/6	Y	204042	49°52.75' N, 119°27.51' W	
	65°	3	Y/N/Y	204255	49°52.75' N, 119°27.49' W	
	70°	3/6	Y	204439	49°52.69' N, 119°27.37' W	
	75°	5/3/5	Y	204533	49°52.69' N, 119°27.37' W	
	0°	5	Y	205207	49°52.73' N, 119°27.44' W	49°52.73' N, 119°27.40' W
	10°	3	Y	205545	49°52.73' N, 119°27.44' W	

AZMTH	TILT	# SATs ACQR'D	ACQT'N (Y OR N)	TIME (UTC)	COORDINATES (LAPTOP)	COORDINATES (BEACON TESTER)
S	20°	3/5	Y	205625	49°52.73' N, 119°27.44' W	
	30°	5	Y	205723	49°52.73' N, 119°27.45' W	
	40°	3/5	Y	205833	49°52.73' N, 119°27.43' W	
	45°	3/5	Y	205925	49°52.71' N, 119°27.42' W	
	50°	4/5	Y	210004	49°52.73' N, 119°27.44' W	
	55°	3/2/5	Y/N	210044	49°52.73' N, 119°27.44' W	
	60°	2/4/2	N/Y/N	210236	49°52.73' N, 119°27.44' W	
	65°	2	N	210419	49°52.73' N, 119°27.44' W	
	70°	3/4	Y	210612	49°52.73' N, 119°27.44' W	
	75°	3	Y	210721	49°52.73' N, 119°27.44' W	
E	0°	6	Y	212919	49°52.74' N, 119°27.49' W	49°52.73' N, 119°27.47' W
	10°	6	Y	213227	49°52.74' N, 119°27.49' W	
	20°	6	Y	213347	49°52.74' N, 119°27.49' W	
	30°	5/6	Y	213414	49°52.74' N, 119°27.49' W	
	40°	6/5	Y	213452	49°52.74' N, 119°27.49' W	
	45°	3/3	Y	213546	49°52.74' N, 119°27.49' W	
	50°	3/5	Y	213658	49°52.74' N, 119°27.49' W	
	55°	5	Y	213728	49°52.74' N, 119°27.49' W	
	60°	5	Y	213814	49°52.74' N, 119°27.49' W	
	65°	3/5	Y	213852	49°52.74' N, 119°27.49' W	
	70°	3	Y	213927	49°52.74' N, 119°27.49' W	
	75°	3	Y	213959	49°52.74' N, 119°27.49' W	
W	0°	5	Y	214237	49°52.74' N, 119°27.34' W	49°52.73' N, 119°27.33' W
	10°	6	Y	214449	49°52.74' N, 119°27.39' W	
	20°	5	Y	214718	49°52.73' N, 119°27.40' W	
	30°	3	Y	214755	49°52.73' N, 119°27.40' W	
	40°	3	Y	214850	49°52.73' N, 119°27.40' W	
	45°	3	Y	214918	49°52.73' N, 119°27.40' W	
	50°	3	Y	214942	49°52.73' N, 119°27.40' W	
	55°	3	Y	215031	49°52.73' N, 119°27.40' W	
	60°	3	Y	215106	49°52.73' N, 119°27.40' W	
	65°	3	Y	215134	49°52.73' N, 119°27.40' W	
	70°	3	Y	215223	49°52.73' N, 119°27.41' W	
	75°	3	Y	215321	49°52.73' N, 119°27.41' W	

The location accuracy was determined from the 406 MHz burst received by the beacon tester. The received long message was decoded and the location accuracy was compared to the test location coordinates as shown in Table 1.

Table 3. Dry Land Tests - Decoded Long Message and Location Accuracy

TIME (UTC)	LONG MESSAGE	LAT	LONG	Δd from actual position
default	FFFE2F93CE1380047FDFF8E9D1C083E0F1AF			
201600	FFFE2F93CE138004322EF5F395401BC26721	49°53.00' N	110°27.60' W	591 m
205347	FFFE2F93CE138004322EF5F395401D029F48	49°52.73' N	119°27.40' W	29 m
213041	FFFE2F93CE138004322EF5F395401D028A72	49°52.73' N	119°27.47' W	84 m
214402	FFFE2F93CE138004322EF5F395401D02A000	49°52.73' N	119°27.33' W	89 m

2.1.4.5 *Analysis*

As shown in Table 2, the unit had trouble maintaining acquisition at about 55° facing north and facing south. No problems were experienced facing east or west. The problem may have been attributable to the GPS satellite distribution during the test or may possibly have been a GPS antenna pattern problem. Further testing may be warranted to determine if there are any nulls in the GPS antenna pattern when mounted on top of the EPIRB.

In addition to the above tests, a rocking test was done to see if acquisition could be achieved and maintained while simulating a sea environment. The beacon was mounted on the ground plane and activated. The ground plane was manually rocked approximately ±75° from horizontal at an approximate repetition rate of 1 second. The unit acquired the GPS satellites and maintained acquisition very well. Occasionally, the unit lost acquisition but re-acquired it very quickly (1 to 3 seconds). The test was conducted with the ground plane rocking in a north-south plane and then an east-west plane.

The Standard Location Protocol was successfully downloaded into the EPIRB's EEPROM once valid location data was acquired from the

GPS receiver and transmitted on the 406 MHz signal. As shown in Table 3, the data was decoded to confirm that the correct location data was transmitted on the burst.

2.1.5 Lake Tests

The Lake Tests were conducted on Okanagan Lake at the Central Okanagan Small Boat Association pier.

2.1.5.1 *Purpose*

To determine the characteristics of acquiring and maintaining acquisition of the GPS satellites using the 50Ω Unit floating in a freshwater lake.

To determine the characteristics of acquiring and maintaining acquisition of the GPS satellites using the Unmodified Unit floating in a freshwater lake and transmitting data to the Cospas-Sarsat satellites and the geostationary satellites (GOES 8 and GOES 9).

2.1.5.2 *Equipment*

The 50Ω Unit and the Unmodified Unit were used in this test.

2.1.5.3 *Procedure*

Both units were deployed in the lake simultaneously. Data was collected on the 50Ω Unit which could be correlated to the data received by the CMCC from the Unmodified Unit.

A laptop computer was used to download the GPS information and a beacon tester was used to decode the 406 MHz transmission (long message format) from the 50Ω Unit. Data from the Unmodified Unit was obtained from the CMCC (event query from the Cospas-Sarsat satellites and raw ASCII data from the GOES satellites).

2.1.5.4 *Lake tests results*

Table 4. Lake Tests -Testing Information

DATE:	September 17, 1996
TESTED BY:	WS/RB
UIN: 50Ω Unit	279C270008FFBFF
Unmodified Unit	279C270004FFBFF
TEST LOCATION COORDINATES:	49°49.94' N, 119°29.36' W

Table 5. Lake Tests - Measured Data

Modified EPIRB				Unmodified EPIRB			
Event	TIME (UTC)	GPS Coord (Laptop)	GPS Coord (Beacon Tester)	GPS Coord from GOES 8 (from MCC)	TIME (UTC)	LEO Doppler Shift Coord (from MCC)	Δd from actual position
Unit ON	174200				173900		
1st Data	174407	49°49.94' N, 119°29.45' W	49°49.93' N, 119°29.40' W	default	173952		
GPS Lost	182148			49°50.07' N 119°29.53' W	174134		318 m
2nd ReAcq	184237	49°49.94' N, 119°29.48' W	49°49.93' N, 119°29.47' W		190600	49°47.9' N, 119°29.1' W	3.8 km
3rd ReAcq	194207	49°49.98' N, 119°29.43' W	49°50.00' N, 119°29.40' W				
4th ReAcq	204037	49°49.89' N, 119°29.40' W	49°49.87' N, 119°29.40' W		204538	49°48.5' N, 119°29.9' W	2.7 km
Unit OFF	210000						

The location accuracy was determined from the decoded 406 MHz burst received by the beacon tester. The received long message was decoded and the location accuracy compared to the test location coordinates as shown in Table 4.

Table 6. Lake Tests - Decoded Long Message and Location Accuracy

TIME (UTC)	LONG MESSAGE	LAT	LONG	Δd from actual position
default	FFFE2F93CE1380047FDFF8E9D1C083E0F1AF			
174500	FFFE2F93CE13800431EEF6E287C093809102	49°49.93' N	119°29.40' W	51 m
184400	FFFE2F93CE13800431EEF6E287C09380843B	49°49.93' N	119°29.47' W	133 m
194340	FFFE2F93CE13800431EEF6E287C093C09C28	49°50.00' N	119°29.40' W	121 m
204200	FFFE2F93CE13800431EEF6E287C093409345	49°49.87' N	119°29.40' W	138 m

2.1.5.5 *Analysis*

As shown in Table 5 and Table 6, the Standard Location Protocol was successfully downloaded into the EPIRB's EEPROM once valid location data was acquired from the GPS receiver. The data was successfully decoded to confirm that the correct location data was transmitted on the burst. The results from GOES 8 show the default location data on the first burst. After 2 minutes and 34 seconds, the GOES satellite received the distress location with an accuracy of 318 m. The time for the first Cospas-Sarsat satellite to receive the transmissions was 1 hour and 27 minutes after activation, with a Doppler location accuracy of 3.8 km.

2.1.6 Sea Tests

2.1.6.1 *Purpose*

To determine the characteristics of acquiring and maintaining acquisition of the GPS satellites using the 50Ω Unit deployed in an open sea environment.

To determine the characteristics of acquiring and maintaining acquisition of the GPS satellite signals using the Unmodified Unit deployed in an open sea environment and transmitting data to the Cospas-Sarsat satellites and GOES satellites.

2.1.6.2 *Equipment*

The 50Ω Unit and the Unmodified Unit were used in this test.

2.1.6.3 *Procedure*

Both units were deployed in the sea simultaneously. Data was collected on the 50Ω Unit which could be correlated to the data received by the CMCC from the Unmodified Unit.

A laptop computer was used to download the GPS information and a beacon tester was used to decode the 406 MHz transmission (long message format) from the 50Ω Unit. Data from the Unmodified Unit was obtained from the CMCC (event query from the Cospas-Sarsat satellites and raw ASCII data from the GOES satellites).

2.1.6.4 *Sea tests results*

Table 7. Sea Tests - Testing Information

DATE:	September 24, 1996
TESTED BY:	WS/RB
UIN: 50Ω Unit **Unmodified Unit**	279C270008FFBFF 279C270004FFBFF
TEST LOCATION COORDINATES: (from ship's DGPS equipment)	49°07.34' N, 123°17.86' W

Table 8. Sea Tests - 50 Ω Unit Results.

TIME (UTC)	HEX ID	LAT	LONG	Accuracy
174000	279C270008FFBFF	-	-	-
174707	279C270008625ED	49°07.26' N	123°20.66' W	273 m

Table 9. Sea Tests - Results from Cospas-Sarsat Satellites

EVENT ID	SAT	TIME (UTC)	HEX ID	LAT	LONG	Probability (%)	Accuracy
52494	C04	191000	279C270004FFBFF	49°07.30' N	123°15.80' W	50	2.49 km
52527	S06	194600	279C270004FFBFF	49°07.60' N	123°18.20' W	98	0.65 km
52534	S04	194900	279C270004625ED	49°07.60' N	123°17.60' W	95	0.58 km
52571	C04	205800	279C270004625ED	49°07.60' N	123°17.60' W	95	0.58 km
52627	S06	212500	279C270004625ED	49°05.30' N	123°20.70' W	94	5.12 km

Table 10. Sea Tests - Results from GOES 8 and GOES 9

SAT	TIME (UTC)	BEACON ID	LAT	LONG	Accuracy
	173700	UNIT ACTIVATED			
GOES 8	173929	93CE1380027FDFFD8A192883EECD90 279C270004FFBFF	-	-	-
GOES 8	174112	93CE138002312F69BD7EE89D22CC77 279C270004FFBFF	49°07.27' N	123°17.80' W	138 m
GOES 9	173831	93CE1380027FDFFD8A192883E0F1AF 279C270004FFBFF	-	-	-
GOES 9	174240	93CE138002312F69BD7EE89D22CC77 279C270004625ED	49°07.27' N	123°17.80' W	138 m

2.1.6.5 *Analysis*

Table 11. Sea Tests - Summary of Sequence of Events

TIME (UTC)	Δ time (hh:mm:ss)	Description
173700	-	Units activated
173831	00:01:31	1st default message received by GOES 9
173929	00:02:29	1st default message received by GOES 8
174112	00:04:12	GPS location message received by GOES 9
174240	00:05:40	GPS location message received by GOES 8
191000	01:33:00	LEO Doppler location from C04
194600	02:09:00	LEO Doppler location from S06
194900	02:12:00	LEO Doppler location from S04
205800	03:21:00	LEO Doppler location from C04
212500	03:48:00	LEO Doppler location from S06

The tests were completed at the test location as shown in Table 7. The 50Ω Unit was deployed and acquired the GPS location data within 7 minutes and 7 seconds, with a location accuracy of 273 m as shown in Table 8. This relatively large location error was due to the fact that the GPS data from the first acquisition was used. Typically, subsequent data points are more accurate as the GPS receiver Horizontal Dilution of Precision (HDOP) improves. For future designs, the HDOP threshold should be lowered so that the first data point is delayed until the set HDOP is reached, or the first data point received should be ignored. The 10th data point would perhaps be more useful (approximately 10 seconds after the first data point).

The results in Table 9 show the Doppler locations as determined by the Cospas-Sarsat satellites. The results vary between 580 m and 5120 m, and are somewhat typical of the Cospas-Sarsat system operation.

The results in Table 10 show the initial results of the GOES 8 and GOES 9 satellites. GOES 9 received the GPS location data 4 minutes and 12 seconds after EPIRB activation. GOES 8 received the GPS location data 5 minutes and 40 seconds after the EPIRB was activated. The location error was 138 m. Table 11 shows a summary of the sequence of events for the Sea Tests.

2.2 Newfoundland Trials

The Newfoundland sea trials were completed by MPR Teltech with a subcontract to OCEANS Ltd. of St. John's, Newfoundland. These tests were completed in December 1995 and the report was published in May 1996.

The complete report entitled *Report on the Initial Sea Trials of the Prototype GPS-EPIRB Off Newfoundland*, Issue 1, dated May 14, 1996, is included as Appendix D.

2.3 DND Northern Field Trials

In May 1997, NAT submitted a GPS-EPIRB to the DND for the purpose of conducting a Demonstration and Evaluation (D&E) to test the viability of using geostationary satellites for receiving 406 MHz transmissions.

A brief report from the DND on this testing is included in Appendix E.

3 CONCLUSIONS

The field trials for the Kelowna and West Coast tests is presented. The first phase of the Kelowna trial consisted of Dry Land Tests to verify the static operation of the GPS-EPIRB on a tiltable aluminum ground plane. The tests verified that the unit could acquire GPS satellite signals and maintain the signals when tilting through ± 75°. The tests also verified that the unit could acquire and maintain acquisition of GPS signals when the unit and ground plane were rocking at a rate of 1 second per tilt cycle.

The second phase consisted of Lake Tests to verify the operation of the GPS-EPIRB while the unit was floating in a calm water environment. The tests verified that the GPS location data was properly downloaded into the EPIRB's EEPROM and transmitted successfully on the 406 MHz message using the Standard Location Protocol. Data was successfully received at the CMCC from GOES 8. This satellite received the distress signal with the GPS location data in 2 minutes and 34 seconds, with an accuracy of 318 m. The first pass of a Cospas-Sarsat satellite occured at 1 hour and 33 minutes after activation.

The Sea Tests consisted of testing the GPS-EPIRB in an open sea environment. The CCG Hovercraft Unit from Richmond B.C. assisted in transporting the team out into the open water. GPS data for the 50Ω Unit was obtained in approximately 7 minutes. This data was successfully encoded onto the 406 MHz transmission. The Cospas-Sarsat satellites determined a Doppler position in 1 hour and 33 minutes. Location accuracies of this pass and subsequent passes varied between 580 m and 5120 m. The GOES 9 and GOES 8 satellites reported a position within 138 m, 4 minutes and 12 seconds, and 5 minutes and 40 seconds, respectively, after activation.

The results of these field trials demonstrated an overwhelming improvement in the system's capability to provide a near-instantaneous alert with location data for a distress situation. With such improvements, valuable SAR forces can be utilized more efficiently, thus reducing the time and cost for search and rescue. The combination of dispatching SAR forces sooner and reducing the

search area could mean the difference between life and death for an accident victim.

4 ADDENDUM

Following the completion of these tests, Northern Airborne Technology Ltd. made the necessary modifications in order to commercialize this GPS-EPIRB. Cospas-Sarsat Type Approval testing was successfully completed. The required national approvals were obtained and the NAT product SATFIND-406 GPIRB™ was introduced in 1998. The GPIRB was the first ever approved EPIRB with an integrated GPS receiver. In 1999, the GPIRB captured two very prestigious design awards: SAIL magazine's Freeman K. Pittman Award and the Seatrade Award in the Safety at Sea category.

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6. *Performance Standard for 406 MHz Satellite Emergency Position Indicating Radio Beacon (EPIRB) Class I and II* (TP 4522E), Transport Canada/Canadian Coast Guard, March 1995.

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8. *Report on the Initial Sea Trials of the Prototype GPS-EPIRB Off Newfoundland*, MPR Teltech Ltd., May 1996.

9. *Specification for COSPAS-SARSAT 406 MHz Distress Beacons* (C/S T.001 Issue 3), Cospas-Sarsat Secretariat, November 1995.

APPENDIX A: Photographs of Kelowna and West Coast Field Trials

DRY LAND TESTS

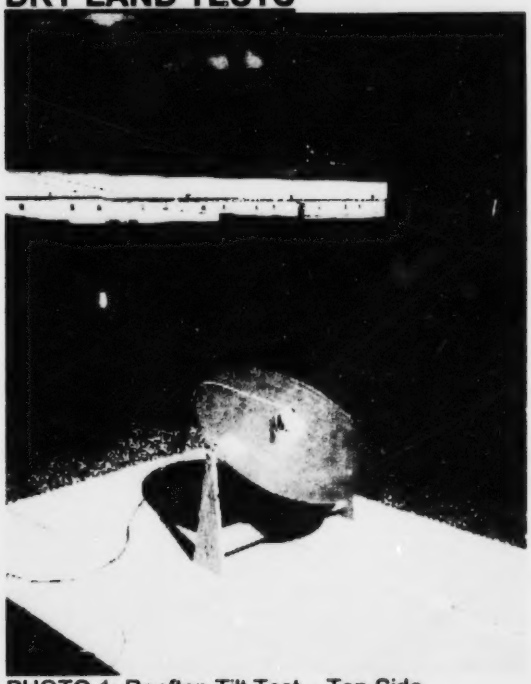

PHOTO 1: Rooftop Tilt Test – Top Side

PHOTO 2: Rooftop Tilt Test – Bottom Side

LAKE TESTS

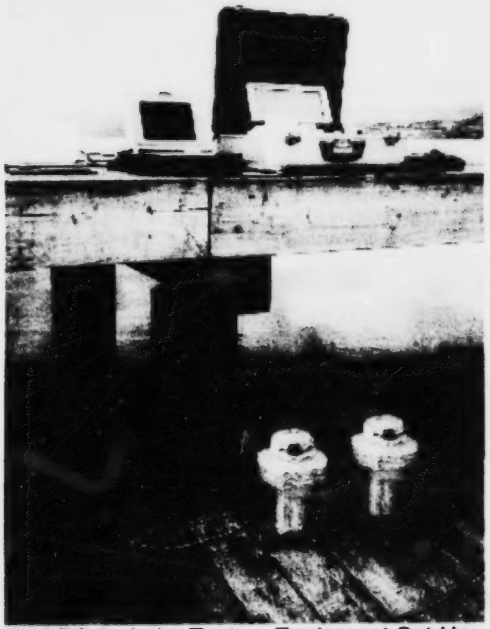

PHOTO 3: Lake Tests – Equipment Set-Up

PHOTO 4: Lake Tests – 50Ω Unit (nearest) and Unmodified Unit (farthest)

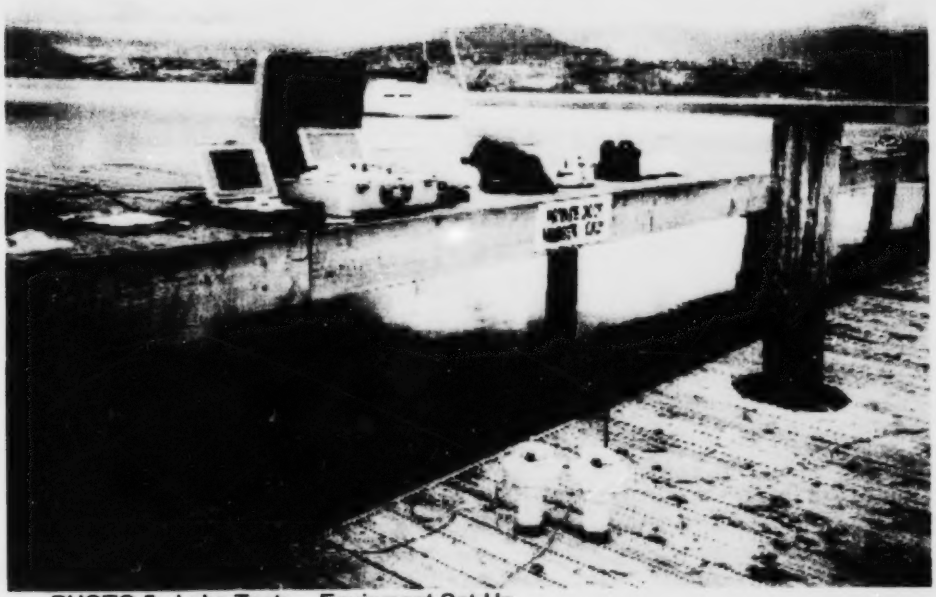

PHOTO 5: Lake Tests – Equipment Set-Up

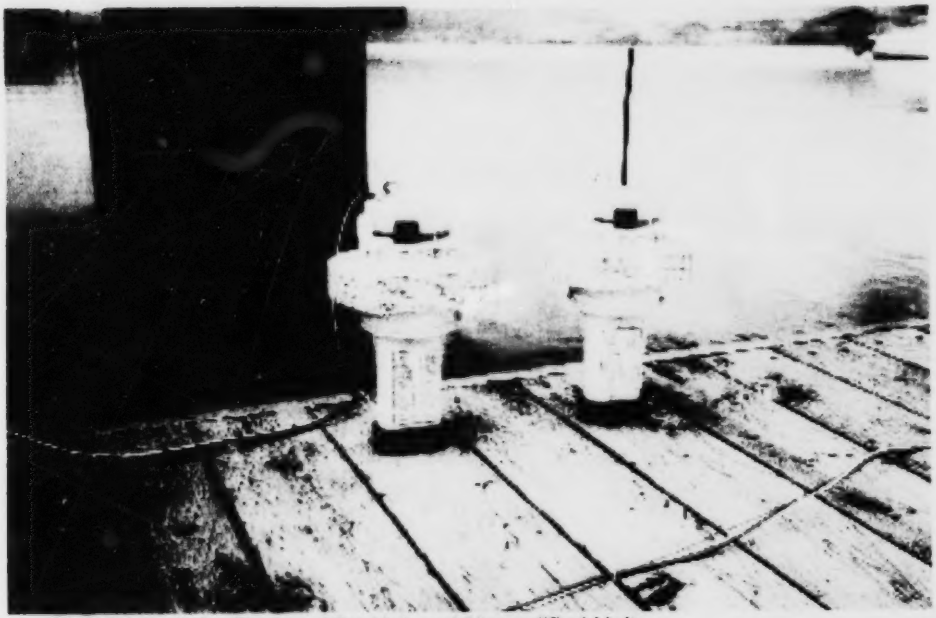

PHOTO 6: Lake Tests – 50Ω Unit and Unmodified Unit

SEA TESTS

PHOTO 7: Hovercraft

PHOTO 8: GPS-EPIRBs Deployed in Open Sea

PHOTO 9: SATFIND-406 GPIRB™

PHOTO 10: 1999 SATFIND-406 GPIRB™ Awards

APPENDIX B: Data from Canadian Mission Control Centre, Trenton

```
CMCC QUERY REPORT          DATABASE: BASIC                  261 2211Z96
NUMBER OF CASES :     0
NUMBER OF EVENTS:     2

EV ID  BIAS  BIASD DRIFT  C LAT      LONG      ANG MAJOR MINOR PR CL SRR  CTA
----- ------ ----- ------ - ------- --------- --- ----- ----- -- -- ---- ------
45383 A    .3   4.0   0.00 3 4948.5N 11929.9W 067 2.500 2.100 98 PR VI07  4.612
F:4   B    .3  16.0   0.00 3 5225.1N 10553.9W 079 6.800 2.800 02 SC TR01 -4.335
R/G:R ITR:5  CNF:3 S:9 PWR:6149 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:261 203844Z96 LOS:261 205358Z96 XMT:261 205733Z96 ST:SUPPRS CASE:00000 000
SRC:3163 M:07193  SC:006 OB:08852  A RS: 1.0 TR:25.0 X:N TCA:261 204538Z96 W:I
PTS 015 TPC:261 2058Z96 R2EV:00000 B RS: 4.0 TR:25.0 X:N TCA:261 204538Z96 W:I
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 63DDE/LAT 0106N/LNG 12347E/SUN/2454/295/16/24

45294 A    .3  10.0   0.00 3 4947.9N 11929.1W 333 2.800 2.300 96 PR VI07 18.556
F:4   B    .2 259.0   0.00 3 6108.5N 05742.3W 352 42.60 27.40 04 SC HA02 -16.89
R/G:R ITR:1  CNF:3 S:9 PWR:0626 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:261 185931Z96 LOS:261 191250Z96 XMT:261 191748Z96 ST:SUPPRS CASE:00000 000
SRC:3163 M:07187  SC:006 OB:08851  A RS: 1.0 TR:25.0 X:N TCA:261 190600Z96 W:I
PTS 008 TPC:261 1918Z96 R2EV:00000 B RS:18.0 TR:25.0 X:N TCA:261 190601Z96 W:I
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 63DDE/LAT 0106N/LNG 12347E/MON/0418/294/16/25
NUMBER OF U406S :     0
```

LAKE TRIAL

LEO data

SEPT 17, 1996 LAKE TEST
GOES 8 DATA

← lat → long

```
>DI,93CE1380027FDFFD8A1928B032E842 960917 173952.495743 400.6 031.6 025631.904 00 0 00000 036.9 1.56 00 000 000
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>DI,93CE1380023IEEF3814F289F019004 960917 181039.980287 400.6 032.7 025607.109 00 0 00000 039.2 1.72 00 000 000
>DI,93CE1380023IEEF3814F28964B8239 960917 181219.885567 400.6 030.8 025605.201 00 0 00000 037.6 1.72 00 000 000
>DI,93CE1380023IEEF3814F28913C1084 960917 181454.773760 400.6 032.6 025605.201 00 0 00000 037.3 1.55 00 000 000
>DI,93CE1380023IEEF3814F2891A5A108 960917 181544.019199 400.6 036.7 025605.201 00 0 00000 041.9 1.63 00 000 000
```

default.

49.83444°N
119.49222°W

49.83444°N
119.35667°W

B-2

SEA TRIAL pg 1 of 3

```
CMCC QUERY REPORT          DATABASE: BASIC                    269 0418Z96
NUMBER OF CASES :     0
NUMBER OF EVENTS:    14

EV ID  BIAS  BIASD DRIFT  C LAT      LONG      ANG MAJOR MINOR PR CL SRR  CTA
------ ------ ----- ------ - -------- --------- --- ----- ----- -- -- ---- -----
52627 A   .3   5.0   0.00 3 4905.3N 12320.7W 065 2.700 2.100 94 PR UI07  3.50
F:4   B   .3  81.0   0.00 3 5059.6N 11332.3W 082 28.80 10.90 06 SC TR01 -3.08
R/G:R ITR:1  CNF:3 S:9 PWR:6711 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 00000028
AOS:268 210313Z96 LOS:268 211823Z96 XMT:268 212502Z96 ST:SUPPRS CASE:00000 00
SRC:3163 M:08187  SC:006 OB:08951  A RS: 1.0 TR:25.0 X:N TCA:268 211000Z96 W:
PTS 014 TPC:268 2125Z96 R2EU:00000 B RS:21.0 TR:25.0 X:N TCA:268 211000Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 625ED/LAT 0106N/LNG 07554W/FRI/0608/314/08/19

52623 A  6.6   5.0   0.00 1 4936.5N 12014.7W 071 147.6 17.10 73 PR UI07  1.42
F:4   B  6.6   5.0   0.00 1 5021.8N 11619.5W 076 146.3 16.90 27 SC UI01 -1.21
R/G:R ITR:2  CNF:1 S:4 PWR:0022 SB:00 SWP:0000 SWD:099 TY:IR CLT:001 00000028
AOS:268 210313Z96 LOS:268 211823Z96 XMT:268 212502Z96 ST:SUPPRS CASE:00000 00
SRC:3163 M:08187  SC:006 OB:08951  A RS:25.0 TR:25.0 X:N TCA:268 210957Z96 W:
PTS 086 TPC:268 2125Z96 R2EU:00000 B RS:25.0 TR:25.0 X:N TCA:268 210957Z96 W:
FF 0/PF 0/CC 000/UC LOC/ID 0000000/MODEL MAR/HS :::/NU/MAN/00
HEX 00000 00000 00000/LAT 0000N/LNG 00000E/:::/:::::/:::::/:::/::

52688 A   .2   4.0   0.00 4 4907.5N 12317.7W 048 2.200 2.000 93 PR UI07 -9.11
F:4   B   .3  57.0   0.00 4 5154.4N 09355.8W 296 14.70 6.400 07 SC TR01  9.70
R/G:G ITR:2  CNF:4 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 00000028
AOS:268 222417Z96 LOS:268 223859Z96 XMT:268 224111Z96 ST:SUPPRS CASE:00000 00
SRC:3163 M:08194  SC:104 OB:36238  A RS: 1.0 TR:25.0 X:N TCA:268 204729Z96 W:
PTS 007 TPC:268 2243Z96 R2EU:00000 B RS: 6.0 TR:25.0 X:N TCA:268 204727Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 625ED/LAT 0106N/LNG 07554W/SUN/0000/000/00/00

52571 A   .2   4.0   0.00 4 4907.6N 12317.6W 042 2.200 2.000 95 PR UI07 -9.11
F:4   B   .3  79.0   0.00 4 5154.3N 09355.8W 302 17.40 7.600 05 SC TR01  9.70
R/G:R ITR:2  CNF:4 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 00000028
AOS:268 203815Z96 LOS:268 205501Z96 XMT:268 205731Z96 ST:SUPPRS CASE:00000 00
SRC:3163 M:08183  SC:104 OB:36237  A RS: 1.0 TR:25.0 X:N TCA:268 204729Z96 W:
PTS 006 TPC:268 2058Z96 R2EU:00000 B RS: 2.0 TR:25.0 X:N TCA:268 204727Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 625ED/LAT 0106N/LNG 07554W/SUN/0000/000/00/00

52527 A   .4  10.0   0.00 3 4907.6N 12318.2W 314 2.200 2.100 98 PR UI07 17.89
F:4   B   .4  65.5   0.00 3 5956.5N 06520.8W 013 33.80 20.30 02 SC HA02 -16.3
R/G:R ITR:1  CNF:3 S:9 PWR:2782 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 00000028
AOS:268 192243Z96 LOS:268 193800Z96 XMT:268 194419Z96 ST:SUPPRS CASE:00000 00
SRC:3162 M:19062  SC:006 OB:08950  A RS: 1.0 TR:25.0 X:N TCA:268 193017Z96 W:
PTS 009 TPC:268 1946Z96 R2EU:00000 B RS:16.0 TR:25.0 X:N TCA:268 193020Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 FFBFF/LAT 0115S/LNG 18060W/MON/2826/263/24/15

52494 A   .3 999.9   0.00 1 5618.8N 03527.7W 331 999.9 93.60 50 PR HA02 26.33
F:4   B   .2 999.9   0.00 1 4907.3N 12315.8W 019 969.7 74.60 50 SC UI07 -23.8
R/G:R ITR:3  CNF:1 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 00000028
AOS:268 185241Z96 LOS:268 190704Z96 XMT:268 190953Z96 ST:SUPPRS CASE:00000 00
SRC:3163 M:08168  SC:104 OB:36236  A RS: 1.0 TR:25.0 X:N TCA:268 185943Z96 W:
PTS 003 TPC:268 1910Z96 R2EU:00000 B RS: 1.0 TR:25.0 X:N TCA:268 185949Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 FFBFF/LAT 0115S/LNG 18060W/SUN/0000/000/00/00
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pg 2 of 3

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52880 A   .4 999.9    0.00 1 4831.5N 12209.9W 318 999.9 82.60 50 PR US03 16.6
F:4   B   .8 999.9    0.00 1 5853.8N 17555.9W 077 999.9 72.90 50 SC US01 -15.9
R/G:G ITR:3  CNF:1 S:9 PWR:2047 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 00000028
ADS:269 000222Z96 LOS:269 001708Z96 XMT:269 002532Z96 ST:SUPPRS CASE:00000 00
SRC:3164 M:28185  SC:004 OB:41255  A RS: 1.0 TR:25.0 X:N TCA:268 174356Z96 W:
PTS 003 TPC:269 0029Z96 R2EV:00000 B RS: 1.0 TR:25.0 X:N TCA:268 174347Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 FFBFF/LAT 0115S/LNG 18060W/MON/2826/263/24/15

52879 A   .3  11.0    0.00 3 4908.3N 12319.4W 009 2.700 2.200 95 PR VI07 15.69
F:4   B   .2 175.0    0.00 3 5832.6N 17304.9W 026 27.10 15.80 05 SC US01 -14.4
R/G:G ITR:1  CNF:3 S:9 PWR:0801 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 00000028
AOS:269 000222Z96 LOS:269 001708Z96 XMT:269 002539Z96 ST:SUPPRS CASE:00000 00
SRC:3164 M:28185  SC:004 OB:41255  A RS: 1.0 TR:25.0 X:N TCA:268 174355Z96 W:
PTS 010 TPC:269 0029Z96 R2EV:00000 B RS:14.0 TR:25.0 X:N TCA:268 174356Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 625ED/LAT 0106N/LNG 07554W/FRI/1906/314/08/23

52837 A   .3  11.0    0.00 3 4907.6N 12320.2W 009 2.700 2.200 94 PR VI07 15.69
F:4   B   .2 175.0    0.00 3 5831.8N 17304.9W 026 27.10 15.80 06 SC US01 -14.4
R/G:G ITR:1  CNF:3 S:9 PWR:0804 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 00000028
AOS:269 000733Z96 LOS:269 002107Z96 XMT:269 002528Z96 ST:SUPPRS CASE:00000 00
SRC:3163 M:08210  SC:004 OB:41255  A RS: 1.0 TR:25.0 X:N TCA:268 174355Z96 W:
PTS 010 TPC:269 0026Z96 R2EV:00000 B RS:14.0 TR:25.0 X:N TCA:268 174356Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 625ED/LAT 0106N/LNG 07554W/FRI/1906/314/08/23

52435 A   .3  13.0    0.00 3 4908.5N 12319.0W 032 2.800 2.200 94 PR VI07 15.69
F:4   B   .3 186.0    0.00 3 5838.8N 17307.2W 002 24.90 13.50 06 SC US01 -14.4
R/G:R ITR:1  CNF:3 S:9 PWR:0955 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 00000028
AOS:268 173552Z96 LOS:268 174742Z96 XMT:268 175009Z96 ST:SUPPRS CASE:00000 00
SRC:3163 M:08159  SC:004 OB:41251  A RS: 1.0 TR:25.0 X:N TCA:268 174355Z96 W:
PTS 008 TPC:268 1817Z96 R2EV:00000 B RS: 9.0 TR:25.0 X:N TCA:268 174354Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 625ED/LAT 0106N/LNG 07554W/FRI/1906/314/08/23

52405 A   .3  13.0    0.00 3 4908.5N 12319.0W 032 2.800 2.200 94 PR VI07 15.69
F:4   B   .3 186.0    0.00 3 5838.8N 17307.2W 002 24.90 13.50 06 SC US01 -14.4
R/G:R ITR:1  CNF:3 S:9 PWR:0955 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 00000028
AOS:268 173552Z96 LOS:268 174742Z96 XMT:268 175009Z96 ST:SUPPRS CASE:00000 00
SRC:3163 M:08159  SC:004 OB:41251  A RS: 1.0 TR:25.0 X:N TCA:268 174355Z96 W:
PTS 008 TPC:268 1750Z96 R2EV:00000 B RS: 9.0 TR:25.0 X:N TCA:268 174354Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 625ED/LAT 0106N/LNG 07554W/FRI/1906/314/08/23

52534 A   .3   1.5    0.00 4 4908.8N 12319.4W 200 1.300  .900 95 PR VI07 15.68
F:4   B   .3   1.5    0.00 4 5840.5N 17253.9W 179 17.80 14.50 05 SC US01 15.68
R/G:G ITR:1  CNF:4 S:9 PWR:0116 SB:00 SWP:0000 SWD:000 TY:EL CLT:001 00000028
AOS:001 000000Z80 LOS:001 000000Z80 XMT:268 192200Z96 ST:SUPPRS CASE:00000 00
SRC:2271 M:79450  SC:004 OB:00000  A RS: 1.4 TR:  .7 X:N TCA:268 174355Z96 W:
PTS 010 TPC:268 1949Z96 R2EV:00000 B RS:26.0 TR:16.6 X:N TCA:268 174355Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 625ED/LAT 0106N/LNG 07554W/FRI/1906/314/08/23

52436 A   .8 999.9    0.00 1 5853.6N 17558.9W 077 999.9 73.00 50 PR US01 -15.9
F:4   B   .4 999.9    0.00 1 4831.7N 12210.0W 318 999.9 82.60 50 SC US03 16.67
R/G:R ITR:3  CNF:1 S:9 PWR:1989 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 00000028
AOS:268 173552Z96 LOS:268 174742Z96 XMT:268 175009Z96 ST:SUPPRS CASE:00000 00
SRC:3163 M:08159  SC:004 OB:41251  A RS: 1.0 TR:25.0 X:N TCA:268 174347Z96 W:C
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pg 3 of 3

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PTS 003 TPC:268 1817Z96 R2EV:00000 B RS: 1.0 TR:25.0 X:N TCA:268 174356Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 FFBFF/LAT 0115S/LNG 18060W/MON/2826/263/24/15

52406 A   .8 999.9   0.00 1 5853.6N 17558.9W 077 999.9 73.00 50 PR US01 -15.9
F:4   B   .4 999.9   0.00 1 4831.7N 12210.0W 318 999.9 82.60 50 SC US03 16.67
R/S:R ITR:3  CNF:1 S:9 PWR:1989 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 00000028
AOS:268 173552Z96 LOS:268 174742Z96 XMT:268 175009Z96 ST:SUPPRS CASE:00000 00
SRC:3163 M:08159  SC:004 OB:41251  A RS: 1.0 TR:25.0 X:N TCA:268 174347Z96 W:
PTS 003 TPC:268 1750Z96 R2EV:00000 B RS: 1.0 TR:25.0 X:N TCA:268 174356Z96 W:
FF 1/PF 0/CC 316/UC LOC/ID 0922496/MODEL MAR/HS :::/EC/MAN/08
HEX 279C2 70004 FFBFF/LAT 0115S/LNG 18060W/MON/2826/263/24/15
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DATA FROM GOES 8 GEOLUT

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>DI,93CE13B0027FDFFD8A192883EECD90 960924 173929.644800 400.6 033.9 025645.256 00 0 00000 038.5 1.59 00 000 000
>MI,93CE13B0027FDFFD8A192883EECD90 960924 173929.644800 400.6 033.9 025645.256 00 0 00000 038.5 1.59 -1 011 037 BAD
>DI,93CE138002312F69BD7EE89D22CC77 960924 174112.157952 400.6 030.8 025635.719 00 0 00000 039.4 1.50 00 000 000
>MI,93CE138002312F69BD7EE89D22CC77 960924 174112.157952 400.6 030.8 025635.719 00 0 00000 039.4 1.50 -1 020 044 BAD
>DI,93CE138002312F69BD7EE89D204F88 960924 174200.930175 400.5 036.4 025631.904 00 0 00000 042.5 1.58 00 000 000
>MI,93CE138002312F69BD7EE89D204F88 960924 174200.930175 400.5 036.4 025631.904 00 0 00001 042.5 1.58 50 020 054 BAD
>DI,93CE138002312F698D7EE89D72E908 960924 174429.877247 400.3 035.5 025628.090 00 0 00000 040.0 1.60 00 000 000
>MI,93CE138002312F698D7EE89D72E908 960924 174429.877247 400.3 035.5 025628.090 00 0 00002 040.0 1.60 50 020 079 BAD
>DI,93CE138002312F69AD7EE89D067400 960924 174520.366079 400.6 036.3 025626.182 00 0 00000 044.1 1.62 00 000 000
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>DI,93CE138002312F698D7EE89D184108 960924 174609.356799 400.6 036.6 025626.182 00 0 00000 041.5 1.61 00 000 000
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>MI,93CE138002312F69BD7EE89D22CC77 960924 174750.127232 400.6 037.7 025626.182 00 0 00005 046.6 1.45 50 020 085 BAD
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>MI,93CE138002312F69BD7EE89D3B1C84 960924 174929.812736 400.6 038.1 025624.275 00 0 00006 044.2 1.57 50 020 090 BAD
>DI,93CE138002312F69BD7EE88C608421 960924 175019.953152 400.6 038.9 025622.367 00 0 00000 045.9 1.69 00 000 000
>MI,93CE138002312F69BD7EE88C608421 960924 175019.953152 400.6 038.9 025622.367 00 0 00007 045.9 1.69 50 020 090 BAD
>DI,93CE138002312F69BD7EE89DDF9210 960924 175107.820288 400.6 035.1 025622.367 00 0 00000 041.1 1.56 00 000 000
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>MI,93CE138002312F69BD7EE923F3E000 960924 175249.262335 400.6 036.4 025622.367 00 0 00008 042.0 1.57 50 020 088 BAD
>DI,93CE138002312F69BD7EE89D72FC84 960924 175341.210496 400.6 036.9 025620.461 00 0 00000 042.6 1.56 00 000 000
>MI,93CE138002312F69BD7EE89D72FC84 960924 175341.210496 400.6 036.9 025620.461 00 0 00009 042.6 1.56 50 020 089 BAD
>DI,93CE138002312F69BD7EE883FE4210 960924 175523.271679 400.6 036.9 025618.553 00 0 00000 041.4 1.57 00 000 000
>MI,93CE138002312F69BD7EE883FE4210 960924 175523.271679 400.6 036.9 025618.553 00 0 00010 041.4 1.57 50 020 083 BAD
>DI,93CE138002312F69BD7EE89D230542 960924 175612.107648 400.6 034.4 025620.461 00 0 00000 040.5 1.69 00 000 000
>MI,93CE138002312F69BD7EE89D230542 960924 175612.107648 400.6 034.4 025620.461 00 0 00000 040.5 1.69 -1 001 092 BAD
>DI,93CE138002312F69BD7EE88DD88F88 960924 175701.460352 400.6 033.8 025618.553 00 0 00000 041.1 1.66 00 000 000
>MI,93CE138002312F69BD7EE88DD88F88 960924 175701.460352 400.6 033.8 025618.553 00 0 00001 041.1 1.66 50 001 084 BAD
>DI,93CE138002312F69BD7EE89D4EFBA1 960924 175752.026623 400.6 035.9 025618.553 00 0 00000 041.6 1.56 00 000 000
>MI,93CE138002312F69BD7EE89D4EFBA1 960924 175752.026623 400.6 035.9 025618.553 00 0 00002 041.6 1.56 50 001 078 BAD
>DI,93CE138002312F69BD7EE89FB08842 960924 175929.542400 400.6 037.3 025616.646 00 0 00000 041.5 1.61 00 000 000
>MI,93CE138002312F69BD7EE89FB08842 960924 175929.542400 400.6 037.3 025616.646 00 0 00003 041.5 1.61 50 001 069 BAD
>DI,93CE138002312F69BD7EE8913D8004 960924 180018.158591 400.6 034.0 025616.646 00 0 00000 039.4 1.59 00 000 000
>MI,93CE138002312F69BD7EE8913D8004 960924 180018.158591 400.6 034.0 025616.646 00 0 00004 039.4 1.59 50 001 059 BAD
>DI,93CE138002312F69BD7EE8633B6421 960924 180157.974016 400.6 035.2 025616.646 00 0 00000 042.3 1.59 00 000 000
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>MI,93CE138002312F69BD7EE899108421 960924 180247.416703 400.6 033.3 025616.646 00 0 00006 040.6 1.64 50 001 055 BAD
>DI,93CE138002312F69BD7EE89C43D420 960924 180339.686783 400.6 033.5 025616.646 00 0 00000 041.0 1.70 00 000 000
>MI,93CE138002312F69BD7EE89C43D420 960924 180339.686783 400.6 033.5 025616.646 00 0 00007 041.0 1.70 50 001 055 BAD
>DI,93CE138002312F69BD7EE89D33F108 960924 180518.443520 400.5 034.2 025616.646 00 0 00000 040.3 1.65 00 000 000
>MI,93CE138002312F69BD7EE89D33F108 960924 180518.443520 400.5 034.2 025616.646 00 0 00008 040.3 1.65 50 001 101 BAD
>DI,93CE138002312F69BD7E9763744210 960924 180608.118400 400.6 034.3 025616.646 00 0 00000 040.7 1.60 00 000 000
>MI,93CE138002312F69BD7ED763744210 960924 180608.118400 400.6 034.3 025616.646 00 0 00009 040.7 1.60 50 001 126 BAD
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1/7

SEA TRIAL
GOES 8 data

DATA FROM GOES 9 GEOLUT

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>DI,93CE1380027FDFFD8A192883E0F1AF 960924 173831.708416 400.6 032.6 025528.908 00 0 00000 041.8 1.59 00 000 000
>MI,93CE1380027FDFFD8A192883E0F1AF 960924 173831.708416 400.6 032.6 025528.908 00 0 00000 041.8 1.59 -1 042 079 BAD
>DI,93CE1380027FDFFD8A192883E0F1AF 960924 174012.296639 400.6 031.2 025509.834 00 0 00000 038.7 1.67 00 000 000
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>DI,93CE138002312F698D7EE89D22CC77 960924 174240.571200 400.6 033.0 025502.205 00 0 00000 041.3 1.57 00 000 000
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SEA TRIAL
GOES 9 data

APPENDIX C: GPS-EPIRB Field Trial Test Plan

GPS-EPIRB Field Trial Test Plan

1.0 Background

Northern Airborne Technology (NAT) is completing work for the Transportation Development Centre on a project entitled *Integration of a Global Positioning System (GPS) Receiver in a Emergency Position Indicating Radio Beacon (EPIRB).* The GPS-EPIRB can receive GPS location information and incorporate it into its 406 MHz distress signal. Further evaluation of the GPS-EPIRB and the system will ensure that the system will operate as intended.

The GPS-EPIRB design allows the unit to be mounted outside on a ship such that the GPS receiver function can be used on the ship via a remote display unit. This display includes control buttons to allow display of latitude and longitude coordinates, speed in knots and km/h, course direction in degrees true and magnetic, and time in local or UTC reference time, and a way point. When the EPIRB is secured in the mounting bracket, a rechargeable battery pack is provided within the bracket, to allow the non-emergency use of the GPS function, without depleting the internal EPIRB battery.

1.1 Introduction

The beacons are TEST coded and will not be considered a distress signal, but any transmissions at 406 MHz will be picked up around the world so it is important to notify the Canadian Mission Control Centre (CMCC) before transmitting. <u>The request to make the test transmissions should be made 24 to 48 hours before the tests begin.</u> The contact there is Paul Martin or the duty person at CMCC Trenton, Ontario. Phone (613) 965-3872 or e-mail at cmcc@reach.net. The information required by the CMCC are:

-the EPIRB registration Number: 15 bit alpha-numeric code.
-the approximate location of the tests.
-the date and and estimated time and duration of the test transmissions.
-a phone contact number. Sometimes if a real distress is in

progress, they will not allow a test to occur, therefore a contact phone number is required to abort a test if necessary.

Data from the satellites should be requested from the CMCC. ie: the correct reception of the EPIRB registration number and the doppler calculated location. Also the latitude and longitude from the long message serialized location protocol from the GOES satellite to verify the GPS-EPIRB and the system is functioning correctly.

Note: The 121.5 MHz homing transmitter is disabled for the duration of the tests.

1.2 General

Two units are used for the testing. One unit is modified to provide an external SMA 50Ω interface for the 406 MHz transmission. This enables the 406 MHz output to be connected to the Sartech tester via a coax cable, preventing the 406 MHz transmission from reaching the satellite, but still being able to determine if the correct message has been transmitted.The second unit is an unmodified unit which transmits the 406 MHz signal to the satellite.

Both units have the 121.5 MHz transmitter disabled to prevent any unnecessary SAR activity.

The units start with fresh batteries and a log is maintained to ensure adequate power is available for the duration of the tests.

Video taping will be conducted on as much of the Sea Trial as possible.

2.0 Test Procedures

2.1 Test 1: Dry Land Test

2.1.1 Purpose

1. To determine how the tilt of the unit will affect the acquisition of satellites for the GPS.

2. To observe the transmission of the location protocol on the 406 MHz transmission.

2.1.2 Procedure

-Mount the modified 50Ω GPS-EPIRB onto the 29 inch diameter aluminum ground plane and tilt jig assembly. Mark a reference position of the EPIRB antenna in relation to the ground plane.
-Connect the RF coax to the Sartech Tester (with the beta version software module for decoding the new location protocols).
-Attach a remote GPS antenna to the ground plane and connect to the Garmin handheld unit. This will allow the monitoring of the GPS satellites that are in view.
-connect the GPS data line to the serial port on the laptop computer.
-with the ground plane level (0°), turn the GPS-EPIRB ON and allow it to acquire as many satellites as possible.
-make a note of the time (UTC) so the GPS data, which is downloaded to a file on the laptop, can be correlated to the tests.
-record the position data from the laptop and from the SARTECH tester.
-tilt the table in 5° increments and monitor if any satellites were lost or if acquisition is lost.
-Note the time from the GPS data on the computer when the tilt is changed.
-repeat up to 75° incline from horizontal.
-repeat the tests with the EPIRB facing South, West and East.

2.2 Test 2: Lake Test

2.2.1 Purpose

1. To determine the characteristics of acquisition and maintaining acquisition of the GPS satellites using a modified 50Ω EPIRB while floating in a fresh water lake.

2. To determine the characteristics of acquisition and maintaining acquisition of an unmodified EPIRB transmitting data to the Cospas-Sarsat satellites and the GOES satellites while floating in a fresh water lake.

2.2.2 Procedure

-Ensure the CMCC has been notified before commencing with this test.
-Allow the Garmin handheld GPS unit to acquire in order to establish a reference time standard (UTC) for correlating data.
-Connect the 50Ω coax cable from the modified 50Ω EPIRB to the input of the Sartech Tester.
-Connect the GPS data line from the modified 50Ω EPIRB to the serial port on the laptop computer.
-Rotate the switch on both EPIRBs to the ARMED position.

-Place both EPIRBs into the water and note the time (UTC).
-From the computer, note how long it takes to acquire 1, 2, 3 ... up to 6 satellites.
-Record the position data of the modified 50Ω EPIRB from the laptop and the SARTECH unit.
-Monitor the GPS data until the EPIRB shuts down the GPS engine (approximately 40 minutes from power up).
-When data (ie: Beacon ID, Cospas Sarsat location, GOES location and UTC time) is received from the CMCC, record on the data sheet.

2.3 Test 3: Sea Trial

2.3.1 Purpose

1. To determine the characteristics of acquisition and maintaining acquisition of the GPS satellites using a modified 50Ω EPIRB when deployed in a rough sea environment.

2. To determine the characteristics of acquisition and maintaining acquisition of an unmodified EPIRB transmitting data to the Cospas-Sarsat satellites and the GOES satellites when deployed in a rough sea environment.

3. To determine the approximate oscillation and degree of tilt of the EPIRB when deployed in a rough sea environment.

2.3.2 Procedure

-Obtain DGPS data from the ship's equipment and record on the data sheet.
-Ensure the CMCC has been notified before commencing with this test.
-Allow the Sony handheld GPS unit to acquire in order to establish a time standard for correlating data.
-Connect the 50Ω coax cable from the modified 50Ω EPIRB to the input of the Sartech Tester.
-Connect the GPS data line from the modified 50Ω EPIRB to the serial port on the laptop computer.
-Rotate the switch on both EPIRBs to the ARMED position.
-Place both EPIRBs into the water and note the time (UTC).
-From the computer, note how long it takes to acquire 1, 2, 3 ... up to 6 satellites.
-Record the position data of the modified 50Ω EPIRB from the laptop and the SARTECH unit.
-Monitor the GPS data until the EPIRB shuts down the GPS engine (approximately 40 minutes).
-When data is received from the CMCC, record on the data sheet.
-from the video tape, approximate the oscillation and degree of tilt of the EPIRB.

APPENDIX D: Report on the Initial Sea Trials of the Prototype GPS-EPIRB Off Newfoundland

MPR TELTECH LTD

REPORT ON THE INITIAL SEA TRIALS OF PROTOTYPE GPS-EPIRB OFF NEWFOUNDLAND

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TABLE OF CONTENTS

1. BACKGROUND 2

2. REFERENCE DOCUMENTS 2

3. TESTING OF THE PROTOTYPE GPS-EPIRB 2
   - 3.1 Introduction 2
   - 3.2 Objectives 3
   - 3.3 Test Plan 3
   - 3.4 Test Results 4
     - Phase 1 4
     - Phase 2 5
     - Phase 3 6
     - Phase 4 7
     - Phase 5 9
     - Phase 6 9
     - Phase 7 10
   - 3.5 Discussion 11

APPENDIX A
TEST PLAN FOR GPS-EPIRB 12

APPENDIX B
GPS EPIRB Test Report 13

APPENDIX C
Test Results For Dec 6,11, 1995. .... " 14

APPENDIX D
Other Fax information from Oceans Ltd. 15

1. BACKGROUND

MPR Teltech is doing work for Transport Canada's Transportation Development Centre on a project entitled "Integration of a Global Positioning System (GPS) Receiver in an Emergency Position Indicating Radio Beacon (EPIRB)". Prototype Units have been designed, built and tested in the laboratory. Some tests have also been conducted on land to check the performance of the GPS and the EPIRB but no tests had yet been conducted at sea.

The GPS-EPIRB design allows the unit to be mounted outside on a ship such that the GPS receiver function can be used on the ship via a remote display unit. This unit includes control buttons to allow display of latitude and longitude coordinates, speed in knots and Km/h, course direction, way point and time in Greenwich (UTC) or local. When the EPIRB is secured in the mounting bracket, a rechargeable battery pack is provided within the bracket to allow non-emergency use of the GPS function, without depleting the internal EPIRB batteries.

2. REFERENCE DOCUMENTS

1. Ocean's Ltd "GPS EPIRB Test Report" "Operational Testing Onboard the CCGS Sir Humphrey Gilbert", dated February 1996.

2. MPR Teltech "TEST PLAN FOR GPS EPIRB" of November 1995.

3. The Canadian Mission Control Centre FAX dated April 29, 1996 from Captain Kelly Freetag to Al Coppin, "Test Results For Dec 6,11, 1995. .....".

3. TESTING OF THE PROTOTYPE GPS-EPIRB

3.1 Introduction

Two of the prototype GPS-EPIRBs built at MPR, were sent to Oceans Ltd of St. John's, Newfoundland in October, 1995 to take part in field testing and evaluation. This became part of work that Oceans were doing during a contract to conduct Search and Rescue target detection experiments in the North Atlantic. The beacon testing took place on December 6 and December 11 1995 onboard the CCGS Sir Humphrey Gilbert in Conception Bay Newfoundland and on the Grand Banks.

3.2 Objectives

The objectives of the tests were:

-to evaluate the performance of the prototype GPS-EPIRB under conditions similar to operational conditions, and

- to evaluate the response of the COSPAS-SARSAT system with both the LEO (Low Earth Orbit) and GOES (Geostationary) satellites in recovering the GPS-EPIRB location information.

3.3 Test Plan

A test plan was prepared by MPR Teltech and approved by Transportation Development Centre for the testing to be done by Oceans Ltd. This Test Plan is included as Appendix A. Careful coordination of the tests with the Canadian Mission Control Centre (CMCC) was vital to the success of the testing.

The beacon serial number is **A79D014ED940401** which is also its COSPAS-SARSAT unique identifier number. The unit is a Class I (Float Free) EPIRB with a GPS receiver built in and capable of transmitting the GPS location using the long message protocol. The unit also has a 121.5 MHz homing transmitter at 25 milliwatts power. The unit was equipped with the automatic release mounting bracket which has a rechargeable battery built in to allow the non-emergency use of the GPS function using the remote display unit.

The tests were conducted by:	Oceans Limited 31 Temperance Street, St. John's Newfoundland, A1C 3J3
Also involved were:	The Canadian Coast Guard (CCG) and the CCGS Sir Humphrey Gilbert.
And coordinated with:	The Canadian Mission Control Centre (CMCC), in Trenton Ontario.

The Test Plan is summarized in seven phases as follows:

Phase 1: To check the EPIRB with its self test. To acquire GPS location with the beacon in the mounting bracket aboard a docked ship and compare the beacon's location output to the ship's GPS readings.

Phase 2: To conduct through-the-satellite tests with the GPS-EPIRB in the mounting bracket aboard a docked ship.

Phase 3: To obtain GPS readings from the beacon with the ship in motion to monitor GPS tracking.

Phase 4: To conduct through-the-satellite tests with the GPS-EPIRB activated in a pail of water.

Phase 5 To evaluate the effect of the sea state by activating the GPS-EPIRB in the sea with the beacon tethered to the ship.

Phase 6 To evaluate the effect of the sea state by activating the GPS-EPIRB in the sea with the beacon tethered to a survival craft.

Phase 7 To determine the effect of the canopy and of the survival craft by manually activating the GPS-EPIRB inside the survival craft.

3.4 Test Results

Phase 1: To check the GPS-EPIRB with its self test. To acquire GPS location with the beacon in the mounting bracket aboard a docked ship and compare the beacon's location output to the ship's GPS readings.

Date of test: December 6, 1995. From 13:20Z to 14:23Z

Test Conditions:
- Ship located at CCG dock in St. John's harbour. GPS-EPIRB in mounting bracket secured to railing on "monkey island" (deck above bridge).
- Wind was negligible
- Cloud cover was about 1/10
- Air temperature was -1° Centigrade

Test Data: At 13:20 Z (UTC or Greenwich mean time) the EPIRB self test was carried out. The EPIRB performed the self test and gave two strobe flashes indicating that the unit had passed.

At 13:58Z the GPS function was enabled with power supplied by the battery contained in the mounting bracket. Remote display unit was attached.

At 14:01Z the beacon display shows GPS acquisition by displaying the coordinates 47° 33.439' N and 052° 42.449' W.

The ship's Differential GPS (DGPS) provides coordinates 47° 33.435' N and 052° 42.437' W.

Results: The deviation of the GPS-EPIRB reading from ship's DGPS is 0.004 minutes north and 0.012 minutes west or about 17 meters. Acquisition took about 3 minutes after activation. The GPS portion of the EPIRB was functioning as intended.

Phase 2: To conduct a through-the-satellite test with the GPS-EPIRB in the mounting bracket aboard a docked ship.

Date of test: December 6, 1996. From about 14:23Z to 16:54

Test Conditions: - Ship was located at the CCG dock in St. John's harbour. -The GPS-EPIRB was in the mounting bracket secured to the railing on the monkey island.

At 14:23Z the GPS-EPIRB was activated by "MANUAL ON".

Test Data: The beacon GPS display reading was 47° 33.436' N and 052° 42.436'W.

The ship's radio immediately began receiving the 121.5 MHz homing signal.

At 15:00Z the CMCC telephoned the ship to confirm that the 406 MHz signal was being received.

At 15:41Z the beacon was switched to "ARMED" which would terminate transmissions.

The CMCC was contacted and confirmed that the location (GPS) data was received from GOES 8.

The time stamps indicate that the signal was first received at CMCC at 14:25Z.

The initial GOES satellite message gave 47° 33' N and 56° 00'E. This longitude was reported as W(est) in the Oceans Report but is East in the CMCC data.

Subsequent messages through GOES indicated a position of 47° 33' N and 52° 42' W.

Ship's position was still 47° 33' N and 52° 42' W.

Test Results: The test was successful. The GOES satellite reception of the signal was recorded about two (2) minutes after the beacon was turned on. It initially gave the right latitude but the wrong longitude. The longitude gave "East"

instead of "West" which indicates major errors can occur if even one "bit" in the message is wrong. This is probably attributable to the GOES space-link path loss. The lat' and long' parts of the message are not error corrected and therefore have a significantly greater chance of being wrong compared to the main identification part of the message which is error corrected and gave accurate data. Therefore error correction is very important for ensuring accurate GOES data. Sometimes one burst is all that is ever received.

Note that with the data protocol used, a location accuracy of only one minute was allowed through the satellites even though the GPS-EPIRB gave better accuracy. The latest location protocols do use error correction and therefore should be much more error resistant. Also, some of the latest location protocols can give as fine as 4 seconds of latitude and longitude accuracy or approximately 100 metres. Subsequent messages from GOES did give correct location data. Even without the error correction, the system can correlate multiple bursts of the data to improve the results.

The coding protocol used was the serialized user location protocol per C/S T.001, issue 2 - Revision 5, September 1993. The latest issue, released November, 1995 provides for BCH error correction on the location portion as well as accuracy to four seconds for lat' and long'.

Additional Data: Information from the CMCC "reference 3", indicated that the Cospas-Sarsat LEO satellites also decoded the GPS-EPIRB signal correctly. The lower orbiting LEO satellites have much less pathloss and therefore even without forward error correction, gave correctly decoded results. Data on the GOES decoding gave almost as many East as West results. The additional data also gave results of the LEO satellites for the doppler on the 121.5 MHz signals. Considerably more variation in the results are indicated which points out the less accurate performance compared to 406 MHz.

Phase 3: To obtain GPS readings from the beacon while the ship is in motion to monitor the GPS-EPIRB tracking.

Date of test: December 6, 1995. From 16:54Z to 17:23Z.

Test Conditions:
-Ship at sea. GPS-EPIRB in the mounting bracket secured to the railing of the monkey island.
-Combined sea was about 2.5 metres.
-The vessel pitch/roll was about ± 10°.

At 16:54 Z, the GPS portion of the beacon was turned on.

Test Data: GPS position displayed at 16:55Z.

The display showed that the GPS remained locked and tracking.

The GPS-EPIRB display showed a heading of 086°@12.9 knots and a position of 47° 34.179' N and 52° 38.103' W.

The ship's DGPS gave a heading of 079°@ 11.7 knots and a position of 47° 34.249' N and 52° 37.329' W.

The EPIRB display reading and the ship's DGPS readings were recorded within one minute of each other.

Test Results: In this test, the GPS-EPIRB operated as expected. The GPS-EPIRB acquired position data in less than a minute and remained locked and tracked as the ship moved. Most of the variance between the beacon GPS results and the ship's GPS results can be attributed to the selective availability aspects of the GPS system. This source of error is considerably reduced with the Differential function of the DGPS system. It is not used in the GPS-EPIRB.

Phase 4: To conduct through-the-satellite tests with the GPS-EPIRB automatically activated in a pail of water. This will check the automatic water activation feature and use water as the ground plane for checking antenna radiation etc., without the effects of waves on the beacon.

Date of test: December 6, 1995. From 17:23Z to 23:30Z.

Test Conditions:
-Initially, the EPIRB was in the mounting bracket and powered up with eternal batteries. Display showed the GPS-EPIRB remained locked and tracked position leading up to the test.
-Combined sea was about 2.5 metres.
-The vessel pitch/roll was about ± 10°.
-The ship's heading was about 079°@ 11.7 knots

Test Data: At 17:20Z, the beacon was removed from the bracket.

At 17:23Z, the beacon was placed in a pail of fresh water on the ship's well deck. Beacon is activated by the water as indicated by the flashing strobe.

At 17:31Z, the ship's heading and location was 079°@ 11.4 knots at 47° 35.458' N and 52° 27.449'W.

At 18:20Z, the ship's position was about 47° 37' N and 52° 14' W.

The CCG at St. John's and the CCG at Halifax requested, by radio, that the beacon be turned off because CMCC Trenton was receiving a 121.5 MHz signal which appeared to be originating "just south of Virgin Rocks" with approximate coordinates of 46° 25' N and 50° 50' W.

At 18:23Z, the beacon was removed from the pail and dried off to deactivate it.

CMCC Trenton was called to ensure they were aware of the tests. They were aware of the tests and knew that the signal could have originated from the test beacon.

A King Air aircraft had been dispatched to the area and expected to be on location at 20:00Z. The Sir Humphrey Gilbert was also diverted to the area to assist in the potential search.

At 23:30Z, the Sir Humphrey Gilbert was notified by rescue coordination centres that the search aircraft had found nothing in the area and the search had been terminated. CMCC Trenton was satisfied that the 121.5 MHz signal had originated from the test beacon.

The Sir Humphrey Gilbert changed course back to the operations area.

Test Results: Due to the concerns with the 121.5 MHz signal, the test was terminated and the results were inconclusive. There was no mention whether the 121.5 MHz signal through the satellite disappeared when the test beacon was shut off but depending on the satellite in view, this might not be accurately determinable.

The ship and beacon were moving at almost 12 knots, so this could have affected the location determination accuracy of the 121.5 MHz signal. It was estimated to be at Virgin Rocks, about 60 nautical miles away from the test beacon position. Due to the nature of the signal, the accuracy of the COSPAS-SARSAT 121.5 MHz location determination is considerably poorer than it is for 406 MHz which is generally within one nautical mile.

Although the beacon was on for about one hour, no information was received on the GPS location data that should have been transmitted by the beacon on 406 MHz and received by GOES and the LEOs. Also, no data was received from the COSPAS-SARSAT LEO system's location determination with doppler, but this might have been overridden by the 121.5 MHz alert.

Additional Results: The additional data from the CMCC Trenton shows that GOES again gave both correct and incorrect location messages. During the time of the test,

there were no location messages from the LEO satellites. The doppler determined positions sometimes showed a "B" solution that was closer to the actual position.

Phase 5: To evaluate the effect of the sea state by activating the GPS-EPIRB in the sea with the beacon tethered to the ship.

Test Data This Phase 5 test was omitted. Oceans Ltd. decided that it was not practical to perform this test using the Sir Humphrey Gilbert as the ship was too large (in excess of 230 ft. long.(70 m.).

Test Results None.

Phase 6: To evaluate the effect of the sea state by activating the GPS-EPIRB in the sea with the beacon tethered to a survival craft.

Date of test: December 11, 1995. From 13:45Z to 19:05Z.

Test Conditions:
-The sea state was less than 1 metre.
-The beacon was tethered to a 4-person life raft by an 8-10 metre one-half inch thick polyethylene rope. (They were concerned about the strength of the supplied lanyard).
-The deployment location was Conception Bay, Newfoundland.
-The ship's DGPS gave 47° 41.64 N and 53° 03.63' W.
-The ship is drifting; not under power.

Test Data: At 13:45Z, the beacon and liferaft were deployed.

At 16:45Z, the beacon and liferaft were retrieved and the beacon was placed in its mounting bracket with the remote GPS display unit attached. The EPIRB was running on external mounting bracket batteries.

The GPS acquired data in less than 10 minutes.

At 17:00Z, the GPS display unit read 47° 42.006' N and 52° 59.474' W.

The ship's DGPS gave 47° 42.006'N and 52° 59.407' W.

1 GOES "hit" at 16:24Z with no location message.

A number of LEO satellite receptions were recorded but none gave a location message.

Test Results: During initial deployment, after the beacon and liferaft had been in the water for three hours, the beacon was retrieved and reinstalled into the mounting bracket to allow the GPS to reacquire its position. Then the beacon and liferaft were again redeployed at 17:00Z. During this phase, there were no location messages through either satellite system. For some reason, the beacon appeared to not be transmitting the location. Further investigation is required but it seems as if the GPS signal was not received and validated by the beacon while the beacon was drifting in the ocean. Even after the beacon was allowed to reacquire in the bracket, the message did not seem to be transmitted to the satellites. More detailed and closely monitored tests must be done.

Additional Results: The CMCC additional data said that for most of that day, the GOES processor was "down" ie. not operational. It also indicated a number of LEO passes but none of them showed a decoded location message. The doppler determined positions by the LEOs were as expected and agreed reasonably well with the ship's DGPS.

Phase 7: To manually activate the GPS-EPIRB inside a survival craft to determine the effect of the canopy and the survival craft.

Date of test: December 11, 1995. From 19:15Z to 20:35Z.

Test Conditions:
- The sea state was less than 1 metre.
- The ship is drifting, not under power.
- The Beacon was placed inside liferaft canopy.
- The liferaft was placed on the well deck of the ship.
- The canopy of the liferaft was damp from ocean spray.

Test Data: At 19:15Z the EPIRB was turned to "MANUAL ON" and placed inside the liferaft.

At 20:35Z the EPIRB was set to "ARMED" which would deactivate it to terminate the test.

No "hits" were received by GOES.

A number of "hits" were recorded by the LEOS.

Test Results: There was no data from GOES. CMCC reported that the GOES system was "down". From the data received from the CMCC, five LEO satellite events gave a Latitude of 47° 40'N and 53° 00'W as location messages. This was from approximately 19:54Z to 21:40Z. Thus, GPS-EPIRB and the system appeared to be functioning correctly during this phase. Unfortunately, there was no information through the GOES system.

Additional Data: Additional information was received from the CMCC which reported on the satellite responses during the test interval. The data was basically the same as was received from the Oceans Report. The CMCC also sent some data regarding the 121.5 MHz signals over the satellite during that time interval.

When the GPS-EPIRB was returned to MPR Teltech, it was checked by self-testing and passed. This indicates that the beacon was basically functioning correctly. The GPS portion was checked by taking the unit outside and allowing it to acquire to the satellite. This also worked correctly.

3.5 Discussion

Overall Results: The GPS-EPIRB operated as expected in most of the phases of the trials. The GPS receiver gave results which compared closely to the Differential GPS which was available on the vessel under the various test conditions. When the GPS receiver was able to provide valid data, the EPIRB transmitted the lat' and long' to the satellites.

The Geostationary GOES satellites sometimes gave totally erroneous location messages. This was probably due to the high path loss of the transmission. Therefore error correction of the data is very important. Note that the error corrected portion of the messages (Unique I.D.) was consistently correct.

The Cospas-Sarsat LEO satellites gave consistently good location messages, probably because of their lower orbits and subsequently lower path loss.

The canopy of the liferaft did not seem to have an effect on the 406 MHz or the 121.5 MHz signals that were picked up by the LEO satellites. The effect would have been more noticeable with the GOES satellites, unfortunately they were not operational at the time.

The critical Phase 6 tests were not successful. The reasons for the failure can not be determined from the data available. More tests are necessary to determine the cause of the problem.

Future Trials: Despite the wet canopy over the GPS-EPIRB in Phase 7, the beacon seemed to be functioning correctly, whereas in the previous Phase 6, the location message was not successfully sent over the satellites. Therefore, there appears to be a significant problem with the GPS-EPIRB when it must acquire location while floating in the open ocean.

The problem appears to be with the GPS portion not being able to provide "valid" data. It may be due to the wave action, or the beacon floatation, or some other effects. More detailed testing is required.

APPENDIX A

TEST PLAN FOR GPS-EPIRB by MPR Teltech Ltd., November 1995, Issue 1.

MPR TELTECH LTD

TEST PLAN FOR THE GPS-EPIRB TRIALS OFF NEWFOUNDLAND

ISSUE NUMBER:	Issue 1
ORIGINATOR:	MPR Teltech Ltd. 8999 Nelson Way Burnaby, B.C. V5A 4B5
SUBMITTED TO:	Transportation Development Centre Advanced Technology Division 800 Rene Levesque Blvd. W.,6th Floor Montreal, Quebec H3B 1X9
DATE:	November 1995.
TDC CONTACT:	Howard Posluns [Tel. (514) 283-0034] [Fax. (514) 283-7158]
MPR TELTECH CONTACT:	Larry Onotera [Tel. (604) 293-5711] [Fax. (604) 293-5711]

TEST PLAN FOR GPS EPIRB

1.0 BACKGROUND

MPR Teltech is completing work for Transport Canada's Transportation Development Centre on a project entitled "Integration of a Global Positioning System (GPS) Receiver in an Emergency Position Indicating Radio Beacon (EPIRB)". The GPS-EPIRB can receive GPS location information and incorporate it into its 406 MHz distress signal. Further evaluation of the GPS-EPIRB and the system will ensure that the system will operate as intended.

The GPS-EPIRB design allows the unit to be mounted outside on a ship such that the GPS receiver function can be used on the ship via a remote display unit. This display includes control buttons to allow display of latitude and longitude coordinates, speed in knots and Km/h, course direction in degrees true and magnetic, and time in local or Greenwich reference time, and a way point. When the EPIRB is secured in the mounting bracket, a rechargeable battery pack is provided within the bracket, to allow the non-emergency use of the GPS function, without depeting the internal EPIRB batteries.

1.1 INTRODUCTION

1.1.1 The beacons are TEST coded and will not be considered as a Distress signal, but any transmissions at 406 MHz will be picked up around the world so it is important to notify the Canadian Mission Control Centre (CMCC) before transmitting. The request to make the test transmissions should be made 24 to 48 hours before the tests begin. The contact there is Major Joan Gordon or the duty person at CMCC Trenton, Ontario. Phone (613) 965-7265 or 1-800-269-7270. Fax (613) 965-7190. They should normally be informed a day at a time.

1.1.2 The information required by the CMCC are:

1) -the EPIRB Reg. No.: example A79D014EC540401
(15 character alpha-numeric code) which is on the side of each EPIRB.

2) -The approximate location of the tests.

3) -The date and estimated time and duration of the test transmissions.

4) - The fact that the unit will be transmitting a 121.5 MHz homing signal.

5) - Also you may request data from the satellites ie.its correct reception of the EPIRB Reg. No. and the doppler calculated location if available. You should also request the latitude and longitude decoded from the long message serialized location protocol,* if available, to verify that the GPS-EPIRB and the system is functioning correctly.

*Note: The CMCC is operating an experimental GOES receiver that allows them to pick up the long message serialized location protocol.(see item 1.1.4)

6) - A phone contact number. Sometimes if a real distress is in progress, they will not allow a test to occur, therefore a contact phone number is required to abort a test if necessary.

1.1.3 Note that the beacon will transmit a lower level homing signal at 121.5 MHz which can and will be picked up by overflying aircraft and by SAR helicopters etc. as well as the satellites. This can be used for final homing onto the beacons in the test trials. CMCC should be informed that the homing transmitter is at 121.5 MHz.

1.1.4 The CMCC might be able to use the testing to evaluate the response from the system using the "GOES" geostationary satellites. The CMCC a few months ago were working on improving the reception through the GOES satellites. Its "footprint" on the Eastern parts of Canada would probably be of interest.

1.2 TESTS TO BE CARRIED OUT.

Please refer to the Owner's Manual for the SATFIND 406 SURVIVAL EPIRB and the Draft "errata" for the GPS-EPIRB for more details on the unit.

1.2.1 EPIRB tests when unit is first received.

1.2.1.1 Do EPIRB "self test" per Owner's Manual page 16.

1.2.1.2 GPS test in bracket - unit should be mounted vertically on the Test Vessel with a fairly clear view of the sky. Use the four bolt holes, two at the top and two at the bottom of the mounting plate. The battery power supply should be connected to the ship's power per the Manual (errata 4th and 5th pages).

1.2.1.3 Press red button on white battery box to turn only GPS section on.

1.2.1.4 With the display unit connected to the battery box, turn on the display unit. It will read "Waiting for GPS to acquire data". Wait up to 10 minutes for initial acquisition. This should take less than a minute after the first time. When the GPS acquires, a "lat and long" will be displayed.

1.2.1.5 Check that the latitude and longitude are correct.eg charts, Loran or other on-board navigational devices, or another GPS unit. The accuracy should be within 200 metres.

1.2.2 GPS tests can be carried out as ship moves to verify the GPS tracking. Latitude and Longitude will update regularly every few seconds.

1.2.3 After informing CMCC, and with the GPS "locked up" ie the display giving a lat and long reading and not waiting to acquire, turn the Beacon to Manual ON in the bracket. This will transmit the GPS lat long to the satellites via the 406 MHz channel. It should give a lat and long message accurate to one nautical mile. CMCC should confirm receipt of message usually within about 1/2 to 1 hour. They can also compare the location determined by the satellites to that determined by the GPS. They could also verify reception of the signal through the GOES satellites.

1.2.4 With EPIRB still set to ARMED, remove EPIRB from bracket and put into a pail of

water. Note that CMCC should be informed if this is done on another day from 1.2.3. It will begin transmission at 406 MHz as indicated by the flashing strobe. Depending on the location of the satellites at the time, it may take up to 30 minutes for the CMCC to pick up the signal. A phone call to them can be made to check whether it was received. Depending on status of the GPS portion, ie whether a valid lat and long was acquired or not when the unit was removed from the bracket, it will transmit either the GPS location or, if the GPS does not have valid data, only the standard serialized protocol message without the lat and long information.

1.2.4.1 If the EPIRB is in ARMED and removed from the water and shaken off, the EPIRB will stop transmission after about a minute as indicated by the strobe stop flashing. Stopping the transmissions between tests will help conserve the battery. In case the unit will not stop transmitting, a DISABLE position is available on the switch lever or the unit can be put back into its bracket. You may need to remove the plastic screw or cut it out to move the lever into the DISABLE position although you should not need to disable it..

1.2.4.2 Note that the beacon can transmit continuously for about 50 hours at which time the internal Beacon batteries will be depleted. A time log estimate would be useful to track the battery's hours used.

1.2.5 If done on another day, advise the CMCC, then repeat the water tests in 1.2.4 above with the beacon floating free but attached to the 8 metre lanyard which is attached to the vessel. Of particular interest is whether the GPS remains locked and the beacon transmits correctly in wavy water conditions. The beacon should be left in the water about an hour to ensure that the CMCC will have received it. This test should be done with the ship drifting free ie not under way.

1.2.6 Repeat similar tests with the beacon attached to a life-raft or small boat with the lanyard.

1.2.7 Similar tests can be carried out simulating a beacon turned on while inside of a liferaft. Turn the switch to MANUAL ON. The unit should be kept vertical with a "radio view" of the sky through the canopy.

1.2.8 The tests are expected to take a total of about 48 hours or less which can be carried out a few hours at a time or whatever is convenient. Note the times, temperatures, water conditions, wind conditions, float condition of the beacon, etc and any other comments as part of the test data. Another concern is water covering the GPS antenna and disabling the GPS.

1.2.9 Complete the Test Record Sheets and provide as much additional information and comments as possible. Include results FAXed from the CMCC, on system response. These test results will be the basis for a formal test report prepared by MPR and submitted to the Transportation Development Centre.

1.2.10 CONTACTS:

Larry Onotera (MPR Teltech) phone: (604) 293-5711 FAX: (604) 293-5754
Steve Bennett (MPR Teltech) phone: (604) 293-5328

Howard Posluns (Transportation Development Centre) phone (514) 283-0034
FAX: (514) 283-7158

Major Joan Gordon (Canadian Mission Control Centre) phone (613) 965-7265
FAX: (613) 965-7190.

TEST RECORD SHEET for GPS-EPIRB

Record name, date, beacon reg no., time, temp, sea and wind conditions, approx location.

TEST	RESULT	COMMENTS
1.2.1.1 EPIRB Self Test	pass fail	
1.2.1.4 GPS test in bracket	acquires in approx. minutes.	location verified?
1.2.2GPS test with vessel in motion.	remains acquired and tracks: yes / no	note sea conditions and ship motion
1.2.3.EPIRB test Manual ON; in bracket.	received by CMCC after min.	location compared?
1.2.4 Beacon test floating in pail. EPIRB ARMED.	received by CMCC after min.	location compared?
1.2.5 Beacon test floating free from ship with lanyard EPIRB ARMED (Ship drifting)	received from CMCC after min.	comments?
1.2.6 Beacon test floating free from liferaft with lanyard EPIRB ARMED.	received from CMCC after min.	comments?
1.2.7 Beacon tests from inside liferaft. EPIRB MANUAL-ON	received from CMCC after min.	comments?

Other comments:

APPENDIX B

GPS EPIRB Test Report by Oceans Ltd., Dated February 1996.

GPS EPIRP Test Report

Operational Testing Onboard the CCGS Sir Humphrey Gilbert

PREPARED FOR:

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AND:

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A1C 3J3

FEBRUARY 1996

/users/oceans/doc/1204

TABLE OF CONTENTS

Page

1. BACKGROUND 1

2. REFERENCE DOCUMENTS 1

3. TEST ARTICLES 1
   - 3.1 General Description 1
   - 3.2 Test GPS EPIRB Identification 2

4. TEST PROCEDURE 2

5. RESULTS 3
   - 5.1 Summary 3
   - 5.2 Other Comments 6

APPENDIX 1 MPR Teltech test plan.

APPENDIX 2 406 MHz data received from CMCC Trenton.

1. BACKGROUND

MPR Teltech, under contract to Transport Canada's Transportation Development Centre (TDC), is currently developing an Emergency Position Indicating Radio Beacon with an integral GPS receiver (GPS EPIRB). This GPS EPIRB receives GPS location information and incorporates it into its 406 MHz distress signal. Work on this project is nearing completion and production prototypes of the beacons have been produced. In October 1995, two of these prototype were shipped to OCEANS Ltd. for field testing and evaluation during a TDC-funded contract to conduct Search and Rescue (SAR) target detection experiments in the North Atlantic. The field phase of this project was undertaken onboard the CCGS Sir Humphrey Gilbert on the Grand Banks (46°35'-48°06'N, 50°00'-52°11'W) and in Conception Bay, Newfoundland (47°35'-47°50'N, 52°50'-53°10'W) in November and December 1995. GPS-EPIRB tests were undertaken on 6 December and 11 December 1995. A description of the testing and results are contained herein.

2. REFERENCE DOCUMENTS

MPR Teltech (November). *Test Plan for GPS EPIRB, Issue 1. (see Appendix 1).*
Alden Electronics (1993, November). *Satfind 406 Survival EPIRB Model S-1000 Owner's Manual.*

3. TEST ARTICLES

3.1 General Description

The MPR Teltech GPS-EPIRB is designed to be installed outdoors in a separate mounting bracket. The mounting bracket interfaces with the ship's power supply and a remote display unit which enables the ship to utilize the beacon as a conventional GPS receiver. The mounting bracket also contains a lead-acid battery which automatically provides power to the beacon in the event of a power interruption. The beacon can be manually removed from its mounting bracket for deployment in an emergency situation. The beacon is automatically released from the bracket by a hydrostatic pressure switch if the beacon is submerged in water below 4 m. A tether line is supplied with the beacon so that it can be attached to a liferaft, lifeboat or person in the water. Optimum signal transmission/reception is achieved with the GPS-EPIRB floating unobstructed in the water.

In its normal operating mode, the 406 MHz distress signal and a 121.5 MHz homing signal are activated automatically as soon as electrical contacts at the base of the beacon are submerged in water. Internal batteries also supply power to a flashing light which provides a visual target for SAR operations. The beacon operates as described above with an external mode switch set to "ARMED". The beacon can also be activated manually be setting the mode switch to "MANUAL ON". A "TEST" position activates the beacon for a short interval for performing monthly self-tests.

3.2 Test GPS-EPIRB Identification

Two Prototype GPS EPIRBs were supplied for testing. Serial numbers were as follows:

Beacon #1: **A79D014ED940401**
Beacon #2: A79D014EC940401

Beacons were TEST encoded so that they would not be considered a distress signal. **Beacon #1 (S/N A79D014ED940401) was used for all testing.**

4. TEST PROCEDURE

Reference: MPR Teltech (November). ***Test Plan for GPS EPIRB, Issue 1. (see Appendix 1).***

All testing was coordinated with Canadian Mission Control Centre (CMCC) Trenton. CMCC Trenton was informed of upcoming tests well in advance of each test period. Audit trails of the 406 MHz data received by CMCC Trenton were to be forwarded by fax to OCEANS Ltd. offices in St. John's. Initial testing on December 6, 1995 produced some confusion at Trenton and in the regional Rescue Coordination Centres in St. John's and Halifax. The regional centres were also given advance notice prior to the second day of tests on December 11, 1995. All testing was conducted onboard the CCGS Sir Humphrey Gilbert.

5. RESULTS

Results of all testing are summarized on the following pages with reference to both the test plan document (Appendix 1) and the 406 MHz data supplied by CMCC Trenton (Appendix 2). The data provided by CMCC Trenton on December 6, 1995 is incomplete. An appropriate audit trail was provided on December 11, 1995, but the fax transmission was very poor. CMCC Trenton (contact Capt. Freitag) is in the process of having the original data from the tests retrieved from archive tapes. This data should be available by mid-March 1996. OCEANS Ltd. has made no attempt to interpret the data provided by CMCC Trenton; this task is the responsibility of the developer, MPR Teltech.

5.1 Summary

Test Plan Reference	Date/ Time	Result	Comments
1.2.1.1 EPIRB Self Test	6 Dec 95 1320Z	Pass	o Strobe flashed twice
1.2.1.4 GPS test in bracket	6 Dec 95 1358Z	Pass. GPS data acquired in approximately 3 minutes	o Bracket was mounted on railing on monkey island (deck above bridge). Ship was at the CCG dock in St. John's Harbour. o 1358Z - Power supplied by 12 VDC external battery. Remote GPS console connected. Initial display read "WAITING FOR GPS TO ACQUIRE DATA". o 1401Z - GPS position supplied by beacon after approx. 3 minutes: 47°33.439'N, 52°42.449'W. Position supplied by ship DGPS: 47°33.435' N, 52°42.437' W. o Environmental: Wx NIL; Cloud cover 1/10; air temp (dry bulb) -1°C; temp (wet bulb) -2.5°C.
1.2.3 EPIRB test Manual on; in bracket	6 Dec 95 1423Z	Signal received by CCMC Trenton after 2 minutes	o Continuation from previous test. Beacon still mounted in bracket on monkey island. Ship at the CCG dock in St. John's Harbour. Power supply via an external battery. Remote GPS console connected. o 1423Z - External mode switch set to "MANUAL ON". Beacon GPS display console reading 47°33.436'N, 52°42.436'W at this instant. Ship began receiving the 121.5 MHz distress signal immediately after the beacon was activated. o 1500Z - CMCC Trenton telephoned ship to confirm that a 406 MHz signal was being received. o 1541Z - EPIRB set to "ARMED". o 1545Z - Called CCMC Trenton to determine nature of signal received. Trenton confirmed that GPS data was being received via the GOES satellite system. o Time stamps in the data provided by CMCC Trenton indicated that signals were first received at 1425Z (approx. 2 minutes following activation). The GPS position provided in the initial GOES satellite message was 47°33'N, 56°00'W. Subsequent messages indicated a position of 47°33' N, 52°42' W. (The ship position remained unchanged from the initial test: 47°33.435'N, 52°42.437W). CMCC Trenton has been contacted for a complete audit trail for this test.

Test Plan Reference	Date/ Time	Result	Comments
1.2.2 GPS test with vessel in motion	6 Dec 95 1654Z	Pass. GPS display remains locked and tracking.	o Continuation from previous test. Ship underway. Beacon mounted in bracket on monkey island. o 1654Z - Power supplied to mounting bracket via external battery. o 1655Z - GPS position displayed in less than 1 minute. Display remained locked and tracking. EPIRB and ship DGPS positions were recorded within one minute of each other for comparison: GPS EPIRB display: heading 086°@12.9 knots, position 47°34.179' N 52°38.103' W; ship DGPS: heading 079°@ 11.7 knots, 47°34.249' N 52°37.329 W. o Combined sea ~2.5 meters. Vessel pitch/roll approximately ± 10°
1.2.4 Beacon test floating in pail. EPIRB ARMED	6 Dec 95 1723Z	Undetermined.	o. Continuation from previous test. EPIRB remained powered up on external batteries. Display remained locked and tracks properly leading up to test. o 1720Z - Beacon removed from bracket. o 1723Z - Beacon placed in pail of fresh water on the ship's well deck. o 1731Z - Ship heading and location: 079°@11.4 knots, 47°35.458' N, 52°W. o Sea and vessel motion as above. (~2.5 m, pitch/roll approx. ± 10°). o 1823Z - EPIRB removed from pail and deactivated (dried off) in response to requests from CCG St. John's and CCG Halifax. CMCC Trenton was receiving a 121.5 MHz signal which appeared to be originating just south of the Virgin Rocks (46°25'N, 50°50'W). Called CMCC Trenton to ensure that they were aware of our tests. The duty officer was aware of the tests and understood that the signal being received could have originated from the test EPIRB. A King Air aircraft had been dispatched to the area and would by on location at 2000Z. The CCGS Sir Humphrey Gilbert was also diverted to the area to assist in the potential search. o 2330Z - Gilbert notified by rescue coordination centres that the search aircraft had found nothing in the area and that the search had been terminated. CMCC Trenton was satisfied that the 121.5 MHz signal had originated from the test beacon. The Sir Humphrey Gilbert changed course back to operations area. o CMCC Trenton has been contacted for a complete audit trail for this test.

1.2.5 Beacon test floating free from ship with lanyard EPIRB ARMED (Ship drifting)		Omitted	o Not practical to perform this test using the Sir Humphrey Gilbert as ship is too large (in excess of 230 ft. long).
1.2.6 Beacon test floating free from liferaft with lanyard EPIRB ARMED	11 Dec 95 1345Z	Undetermined. Cannot interpret CMCC data.	o 1345Z - Deployed beacon tethered from a 4-person life raft. An 8-10 meter 1/2 inch polyethylene rope was used instead of the supplied lanyard; we were concerned about not getting the EPIRB back. Deployment location was in Conception Bay, Newfoundland. Deployment location according to ship DGPS: 47°41.64'N, 53°03.63'W. o Environmental: Seas less than 1 meter o 1645Z - Realized that GPS had not been powered up prior to test to acquire GPS data. Liferaft and EPIRB were retrieved and beacon was placed in mounting bracket with remote GPS display unit attached. GPS is running on lead-acid battery inside the mounting bracket. GPS acquires data in <10 minutes. o 1700Z - GPS display unit reading 47°42.006'N, 52°.59.474'W. Ship DGPS reading 47°42.006'N,52°59.407'W. Ship is drifting; not under power. o 1705Z - GPS-EPIRB removed from bracket. o 1715Z - EPIRB and raft re-deployed. o 1730 - Called CMCC Trenton to discuss results. Their data indicated that the 406 MHz signal had stopped briefly. They did not receive GPS position information prior to the break in the signal. They were not currently receiving GPS information either. o 1905Z - Liferaft retrieved and Beacon deactivated (contacts dried off).
1.2.7 Beacon tests from inside liferaft. EPIRB MANUAL-ON	11 Dec 95 1915Z	Undetermined. Cannot interpret CMCC data.	o 1915Z - EPIRB set on MANUAL-ON inside liferaft canopy. Liferaft on well deck of the Gilbert. Canopy is damp from ocean spray. o 2035Z - EPIRB set to ARMED. Test terminated.

5.2 Other Comments

- Disable the 121.5 MHz homing signal when conducting 406 MHz tests. CMCC Trenton personnel have explained that the 121.5 MHz signals are difficult to interpret and location errors and false alarms can result.
- Lanyard supplied with the beacon appears flimsy. It is unlikely that the user would use this line as a tether in an emergency situation. Although the line has adequate tensile strength for the application, it may chafe through quickly in rough seas.
- Estimated beacon (lithium) battery usage is 7 h 10 min (test 1.2.4: 1h; 1.2.6: 4 h 50 min; 1.2.7: 1h 20 min).
- Estimated mounting bracket (lead-acid) battery usage is <20 min (test 1.2.6).

APPENDIX C

Test Results For Dec 6,11, 1995. .... ", The Canadian Mission Control Centre FAX dated April 29, 1996 from Captain Kelly Freetag to Al Coppin.

THE CANADIAN MISSION CONTROL CENTRE

LE CENTRE CANADIEN DE CONTROLE DES MISSIONS

CFB TRENTON
ASTRA, ONTARIO
CANADA
K0K 1B0

TEL: (613) 965-7265
GP CSN: 827-7265
FAX: (613) 965-7190

FROM: CAPT Kelly Freitag

TO: AL COPIN

NAME:		FAX:	604 273-5754
DESIG/LOC:		TEL:	
OTHER:			

REMARKS: TEST Results For Dec 6, 11, 1995. CMCC can process Locator Beacons via the old protical the new protical will be in place this fall (or earlier if their are beacons available), otherwise will ~~diff~~ decode manually.

NUMBER OF PAGES INCLUDING THIS PAGE: 17

Call if there are any problems

6 Dec 95 406

DATABASE MAINTENANCE - QUERY
AUX ALERT DATABASE QUERY

System Manager report for printer.

SUBJECT TYPE - CASE/EVENT/UNLOCATED 406 (C/E/U): C,E,U
CONDITIONS
TCA START: 340 1415295 END: 340 1830295 OR LAST HRS MINS
FREQ: 4 BIAS RANGE: LOW: KHz HIGH: KHz
GEOGRAPHY - CENTER RADIUS OR CENTER BOX OR FLIGHT PATH (R/B/P): R
LOCATION1: LAT 4742.0N LONG 05259.4W WIDTH 200 Naut. mi.
LOCATION2: LAT LONG LENGTH Naut. mi.
BEACON ID: A79D014ED940401 COUNTRY CODE: PROTOCOL FLAG:
^ ^ REAL DATA/GLOBAL DATA/BOTH (R/G/B):
SRR: SATELLITES:
SOURCES: ORBIT NUMBER:
STATUS:
CONFIDENCE: USER CLASS: (PROTOCOL FLAG=1 ONLY)
SIGNAL TYPE - ELT/INTERFERER/UNKNOWN (EL/IR/UN):
DESTINATIONS:
TRANSMIT TIME START: END:

Distance between 406 case # 55680 and GPS
is approx 4600 meters

Distance between Ship DGPS + ESIRB GPS = approx 14 meters
for 6 Dec 95

P1.1

```
CMCC QUERY REPORT          DATABASE: AUXILIARY          120 1513Z96
NUMBER OF CASES :     1

CS ID REV F BIAS  BIASD LAT     LONG      ANG MAJOR MINOR CC  CL SRR  TY S PWR
----- --- - ----- ----- ------- --------- --- ----- ----- --- -- ---- -- - ----
55680   1 4    .2  2.00 4735.9N 05242.4W 103 2.314 1.370   2    HA02 EL 9 9999
R/G:G SWP:0000 SWD:099  FMT:340 142544Z95 UPT:340 182135Z95  CLT:341 122144Z95
CNF:4  ST:AGED    M2CS: 0000 000
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 0000N/LNG 00000E/:::/:::::/:::::/:::/::
NUMBER OF EVENTS:     8

EV ID  BIAS  BIASD DRIFT  C LAT     LONG      ANG MAJOR MINOR PR CL SRR  CTA
----- ------ ----- ------ - ------- --------- --- ----- ----- -- -- ---- ------
05226 A   .2   6.6   0.00 1 4755.1N 05519.7W 087 134.8 23.60 50 IM HA02  1.169
F:4   B   .2   6.6   0.00 1 4739.0N 05219.2W 288 132.5 23.40 50 AC HA02  -.878
R/G:G ITR:3  CNF:1 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:340 200123Z95 LOS:340 201740Z95 XMT:340 202111Z95 ST:RDNDNT CASE:00000 000
SRC:3162 M:12282  SC:106 OB:23749  A RS: 1.0 TR:25.0 X:N TCA:340 182136Z95 W:I
PTS 003 TPC:340 2022Z95 R2EV:05120 B RS: 1.0 TR:25.0 X:N TCA:340 182136Z95 W:I
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 0000N/LNG 00000E/:::/:::::/:::::/:::/::

05216 A   .2   1.0   0.00 3 4754.7N 05523.0W 274 11.40 2.100 64 IM HA02  1.205
F:4   B   .2   2.0   0.00 3 4737.1N 05214.1W 282 20.20 2.400 36 AC HA02  -.938
R/G:G ITR:2  CNF:3 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:340 200053Z95 LOS:340 201714Z95 XMT:340 202046Z95 ST:RDNDNT CASE:00000 000
SRC:3161 M:22766  SC:106 OB:23749  A RS: 1.0 TR:25.0 X:N TCA:340 182136Z95 W:I
PTS 006 TPC:340 2021Z95 R2EV:05120 B RS: 2.0 TR:25.0 X:N TCA:340 182135Z95 W:I
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 0000N/LNG 00000E/:::/:::::/:::::/:::/::

05129 A   .2   1.0   0.00 3 4754.7N 05522.7W 274 12.20 2.200 64 IM HA02  1.203
F:4   B   .2   2.0   0.00 3 4737.2N 05214.4W 282 21.10 2.500 36 AC HA02  -.935
R/G:R ITR:2  CNF:3 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:340 181435Z95 LOS:340 183130Z95 XMT:340 183415Z95 ST:RDNDNT CASE:00000 000
SRC:3161 M:22747  SC:106 OB:23748  A RS: 1.0 TR:25.0 X:N TCA:340 182136Z95 W:I
PTS 006 TPC:340 1835Z95 R2EV:05120 B RS: 2.0 TR:25.0 X:N TCA:340 182135Z95 W:I
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 0000N/LNG 00000E/:::/:::::/:::::/:::/::

05202 A   .2   1.0   0.00 3 4754.8N 05522.0W 274 12.00 2.200 64 IM HA02  1.193
F:4   B   .2   2.0   0.00 3 4737.4N 05215.2W 282 20.80 2.400 36 AC HA02  -.926
R/G:G ITR:2  CNF:3 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:340 200231Z95 LOS:340 201451Z95 XMT:340 201741Z95 ST:RDNDNT CASE:00000 000
SRC:3163 M:34115  SC:106 OB:23749  A RS: 1.0 TR:25.0 X:N TCA:340 182136Z95 W:I
PTS 006 TPC:340 2018Z95 R2EV:05120 B RS: 2.0 TR:25.0 X:N TCA:340 182135Z95 W:I
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 0000N/LNG 00000E/:::/:::::/:::::/:::/::

05120 A   .2   1.0   0.00 3 4754.8N 05521.7W 274 12.50 2.200 64 IM HA02  1.190
F:4   B   .2   2.0   0.00 3 4737.5N 05215.4W 282 21.40 2.500 36 AC HA02  -.923
R/G:G ITR:2  CNF:3 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:340 182000Z95 LOS:340 183118Z95 XMT:340 183327Z95 ST:CONFRM CASE:55680 001
SRC:3162 M:12263  SC:106 OB:23748  A RS: 1.0 TR:25.0 X:N TCA:340 182136Z95 W:I
PTS 006 TPC:340 1834Z95 R2EV:00000 B RS: 2.0 TR:25.0 X:N TCA:340 182135Z95 W:I
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04968 A   .2   0.0   0.00 4 4733.6N 05242.6W 084 2.700 2.000 95 AC HA02  3.608
F:4   B   .2   1.0   0.00 4 4642.1N 04242.1W 291 6.700 2.500 05 IM HA02 -3.275
R/G:R ITR:7  CNF:4 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:340 151924Z95 LOS:340 153557Z95 XMT:340 154452Z95 ST:CONFRM CASE:55680 000
SRC:3161 M:22715  SC:104 OB:32211  A RS: 1.0 TR:25.0 X:N TCA:340 152558Z95 W:I
PTS 019 TPC:340 1545Z95 R2EV:00000 B RS: 2.0 TR:25.0 X:N TCA:340 152559Z95 W:I
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 0000N/LNG 00000E/:::/:::::/:::/::/::

04917 A   .2   2.0   0.00 4 4733.7N 05245.0W 302 6.700 2.600 67 AC HA02  5.533
F:4   B   .2   4.0   0.00 4 5032.9N 06831.7W 090 12.90 4.000 33 IM HA01 -5.245
R/G:R ITR:2  CNF:4 S:9 PWR:2898 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:340 142013Z95 LOS:340 143431Z95 XMT:340 143822Z95 ST:CONFRM CASE:55680 000
SRC:3164 M:03422  SC:002 OB:56627  A RS: 3.0 TR:25.0 X:N TCA:340 142544Z95 W:I
PTS 009 TPC:340 1439Z95 R2EV:00000 B RS: 6.0 TR:25.0 X:N TCA:340 142545Z95 W:I
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/MAN/00
HEX A79D0 14ED9 40401/LAT 4733N/LNG 05242W/:::/::::/:::/::/::

04908 A   .2   1.0   0.00 4 4732.8N 05242.5W 294 4.500 2.100 57 PR HA02  5.576
F:4   B   .2   2.0   0.00 4 5033.9N 06840.3W 278 5.600 2.200 43 SC HA01 -5.326
R/G:R ITR:2  CNF:4 S:9 PWR:2792 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:340 141706Z95 LOS:340 143210Z95 XMT:340 143630Z95 ST:RDNDNT CASE:00000 000
SRC:3161 M:22709  SC:002 OB:56627  A RS: 1.0 TR:25.0 X:N TCA:340 142544Z95 W:O
PTS 008 TPC:340 1437Z95 R2EV:04917 B RS: 2.0 TR:25.0 X:N TCA:340 142545Z95 W:O
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/MAN/00
HEX A79D0 14ED9 40401/LAT 4733N/LNG 05242W/:::/::::/:::/::/::
NUMBER OF U406S :    6

U4 ID   SRC     MSGNM   MSG RCVD TIME   SAT   ORBNM   TCA
-----   ----    -----   -------------   ---   -----   -------------
16359   3163    34144   340 224941Z95     4   37116   340 173557Z95
STATUS: RDNDNT  TPC:  340 2251Z95   CLT:  340 2251Z95  PTS:  1
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 4735N/LNG 05230W/:::/::::/:::/::/::

16344   3162    12258   340 175036Z95     4   37113   340 173557Z95
STATUS: RDNDNT  TPC:  340 1752Z95   CLT:  340 1752Z95  PTS:  1
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 4735N/LNG 05230W/:::/::::/:::/::/::

16348   3161    22759   340 192710Z95     4   37114   340 173557Z95
STATUS: RDNDNT  TPC:  340 1929Z95   CLT:  340 1929Z95  PTS:  1
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 4735N/LNG 05230W/:::/::::/:::/::/::

16342   3165       93   340 172700Z95   208       0   340 172733Z95
STATUS: AGED    TPC:  340 1728Z95   CLT:  341 0145Z95  PTS:  1
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 4735N/LNG 09600E/:::/::::/:::/::/::

16341   3165       92   340 172400Z95   208       0   340 172416Z95
STATUS: RDNDNT  TPC:  340 1724Z95   CLT:  340 1834Z95  PTS:  1
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/::::/::::/::::/::/::

16326   3165       84   340 142500Z95   208       0   340 142551Z95
STATUS: RDNDNT  TPC:  340 1426Z95   CLT:  340 1437Z95  PTS:  1
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
```

6139657190 RCC TRENTON F-813 T-875 P-005 APR 29 '96 16:50

6 Dec 95 121.5/243.0

DATABASE MAINTENANCE - QUERY
AUX ALERT DATABASE QUERY

System Manager report for printer.

SUBJECT TYPE - CASE/EVENT/UNLOCATED 406 (C/E/U): C,E
CONDITIONS
TCA START: 340 1415Z95 END: 340 1830Z95 OR LAST HRS MINS
FREQ: 1 2 3 BIAS RANGE: LOW: KHz HIGH: KHz
GEOGRAPHY - CENTER RADIUS OR CENTER BOX OR FLIGHT PATH (R/B/P): R
LOCATION1: LAT 4742.0N LONG 05259.4W WIDTH 200 Naut. mi.
LOCATION2: LAT LONG LENGTH Naut. mi.
BEACON ID: COUNTRY CODE: PROTOCOL FLAG:
^ ^ REAL DATA/GLOBAL DATA/BOTH (R/G/B):
SRR: SATELLITES:
SOURCES: ORBIT NUMBER:
STATUS:
CONFIDENCE: | USER CLASS: (PROTOCOL FLAG=1 ONLY)
SIGNAL TYPE - ELT/INTERFERER/UNKNOWN (EL/IR/UN):
DESTINATIONS:
TRANSMIT TIME START: END:

1708 Z is the last time 121.5 signal received but 406 data was received up until 1821Z. So it appears that 121.5 signal ceased after GPS-EPIRB was disabled.

Distance between 121.5 case # 55691 & GPS 4733.4 N 05242.5 W is 234.7 Km. I don't know why it is so far out.

02.1

P.2.2

CMCC QUERY REPORT DATABASE: AUXILIARY 120 1512Z96
NUMBER OF CASES : 1

CS ID	REV	F	BIAS	BIASD	LAT	LONG	ANG	MAJOR	MINOR	CC	CL	SRR	TY	S	PWR
55691	0	1	-1.3	3.00	4608.1N	05025.4W	101	5.615	4.638	1		HA02	UN	7	35

R/G:R SWP:0000 SWD:099 FMT:340 142555Z95 UPT:340 170809Z95 CLT:341 013432Z95
CNF:3 ST:AGED M2CS: 0000 000
NUMBER OF EVENTS: 7

EV ID		BIAS	BIASD	DRIFT	C	LAT	LONG	ANG	MAJOR	MINOR	PR	CL	SRR	CTA
05039	A	-.9	9.7	0.00	2	4514.5N	06528.7W	072	57.30	6.900	50	AC	HA02	4.076
F:1	B	-.9	9.7	0.00	2	4723.0N	05407.1W	076	55.60	6.500	50	IM	HA02	4.076

R/G:R ITR:0 CNF:2 S:0 PWR:0000 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
ADS:001 000000Z80 LOS:001 000000Z80 XMT:340 171500Z95 ST:CONFRM CASE:55689 000
SRC:3581 M:31804 SC:006 OB:00000 A RS:14.0 TR: 6.1 X:N TCA:340 170832Z95 W:0
PTS 000 TPC:340 1717Z95 R2EV:00000 B RS:13.7 TR: .2 X:N TCA:340 170832Z95 W:0

05047	A	-1.3	3.0	0.00	3	4251.3N	06844.3W	060	30.30	14.50	81	IM	US01	7.344
F:1	B	-1.3	3.0	0.00	3	4642.1N	04915.8W	089	30.10	14.10	19	AC	HA02	-7.007

R/G:R ITR:1 CNF:3 S:7 PWR:0035 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
ADS:340 170251Z95 LOS:340 171802Z95 XMT:340 172443Z95 ST:CONFRM CASE:55691 000
SRC:3161 M:22735 SC:006 OB:04815 A RS:25.0 TR:25.0 X:N TCA:340 170809Z95 W:I
PTS 099 TPC:340 1725Z95 R2EV:00000 B RS:25.0 TR:25.0 X:N TCA:340 170809Z95 W:I

05004	A	1.0	6.6	0.00	1	4832.8N	05447.1W	333	65.00	47.70	65	PR	HA02	18.281
F:1	B	1.0	6.6	0.00	1	4439.7N	00321.6W	039	56.50	44.20	35	SC	FR01	-16.72

R/G:R ITR:4 CNF:1 S:4 PWR:0020 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
ADS:340 163237Z95 LOS:340 164457Z95 XMT:340 165503Z95 ST:SUPPRS CASE:00000 000
SRC:3161 M:22727 SC:106 OB:23747 A RS:25.0 TR:25.0 X:N TCA:340 163710Z95 W:I
PTS 099 TPC:340 1656Z95 R2EV:00000 B RS:25.0 TR:25.0 X:N TCA:340 163715Z95 W:I

04950	A	-.1	22.5	0.00	1	4621.1N	04054.5W	283	140.6	9.100	50	PR	HA02	4.689
F:1	B	-.1	22.5	0.00	1	4735.6N	05430.0W	272	145.1	9.500	50	SC	HA02	4.689

R/G:R ITR:0 CNF:1 S:0 PWR:0000 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
ADS:001 000000Z80 LOS:001 000000Z80 XMT:340 153500Z95 ST:SUPPRS CASE:00000 000
SRC:3582 M:31798 SC:104 OB:00000 A RS:14.0 TR: .1 X:N TCA:340 152557Z95 W:0
PTS 000 TPC:340 1536Z95 R2EV:00000 B RS:14.0 TR: .1 X:N TCA:340 152557Z95 W:0

04946	A	-.8	3.1	0.00	4	4604.1N	05027.4W	285	5.800	4.900	50	AC	HA02	7.369
F:1	B	-.8	3.1	0.00	4	5013.2N	07139.5W	289	5.600	4.600	50	IM	TR01	7.369

R/G:R ITR:0 CNF:2 S:0 PWR:0000 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
ADS:001 000000Z80 LOS:001 000000Z80 XMT:340 144200Z95 ST:CONFRM CASE:55691 000
SRC:3666 M:31794 SC:002 OB:00000 A RS:14.4 TR: .3 X:N TCA:340 142555Z95 W:I
PTS 000 TPC:340 1443Z95 R2EV:00000 B RS:14.7 TR: 2.3 X:N TCA:340 142555Z95 W:I

04898	A	-.7	6.6	0.00	2	4634.0N	05010.1W	276	56.60	23.20	90	PR	HA02	7.558
F:1	B	-.8	6.6	0.00	2	5034.6N	07114.2W	299	60.10	21.20	10	SC	TR01	-6.943

R/G:R ITR:1 CNF:2 S:4 PWR:0024 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
ADS:340 141706Z95 LOS:340 143210Z95 XMT:340 143630Z95 ST:RDNONT CASE:00000 000
SRC:3161 M:22709 SC:002 OB:56627 A RS:25.0 TR:25.0 X:N TCA:340 142547Z95 W:I
PTS 099 TPC:340 1437Z95 R2EV:04946 B RS:24.0 TR:25.0 X:N TCA:340 142549Z95 W:I

04911	A	-.7	6.6	0.00	2	5044.8N	07149.9W	288	41.00	21.80	50	PR	TR01	-7.351
F:1	B	-.7	6.6	0.00	2	4629.2N	04952.6W	281	41.20	22.90	50	SC	HA02	7.764

R/G:R ITR:1 CNF:2 S:4 PWR:0024 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80

PTS 099 TPC:340 1439Z95 R2EV:04946 B RS:23.0 TR:25.0 X:N TCA:340 142547Z95 W:I

p2.3

406 11 Dec 95

DATABASE MAINTENANCE - QUERY
AUX ALERT DATABASE QUERY

System Manager report for printer.

SUBJECT TYPE - CASE/EVENT/UNLOCATED 406 (C/E/U): C,E,U
CONDITIONS 1345
TCA START: 345 ~~1640~~295 END: 345 2040295 OR LAST HRS MINS
FREQ: 4 BIAS RANGE: LOW: KHz HIGH: KHz
GEOGRAPHY - CENTER RADIUS OR CENTER BOX OR FLIGHT PATH (R/B/P): R
LOCATION1: LAT 4742.0N LONG 05259.4W WIDTH 200 Naut. mi.
LOCATION2: LAT LONG LENGTH Naut. mi.
BEACON ID: A79D014ED940401 COUNTRY CODE: PROTOCOL FLAG:
REAL DATA/GLOBAL DATA/BOTH (R/G/B):
SRR: SATELLITES:
SOURCES: ORBIT NUMBER:
STATUS:
CONFIDENCE: USER CLASS: (PROTOCOL FLAG=1 ONLY)
SIGNAL TYPE - ELT/INTERFERER/UNKNOWN (EL/IR/UN):
DESTINATIONS:
TRANSMIT TIME START: END:

CNCC capability to process locator Beacons is via the old protical method. Our programmer said he would have it ready by fall, or sooner if he new there were any beacons out there using the new protical.

2) GOES SAT: down during this test period.
- only one Hit detected.

Distance between GPS and case (406) 55797 is 1700 meters

Distance between GPS (ship) & GPS (CFSRB) is approx 266 meters
for Dec 11, 1995

P 3.1

1 of 2

CMCC QUERY REPORT DATABASE: AUXILIARY 120 1606Z96
NUMBER OF CASES : 1

CS ID	REV	F	BIAS	BIASD	LAT	LONG	ANG	MAJOR	MINOR	CC	CL	SRR	TY	S	PWR
55797	8	4	.2	0.00	4741.8N	05300.8W	78	1.136	.868	9	TE	HA02	EL	9	3458

R/G:G SWP:0000 SWD:099 FMT:345 141725Z95 UPT:345 195239Z95 CLT:346 143510Z95
CNF:4 ST:AGED M2CS: 0000 000
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/MAN/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::/:::/:::/:::/:::/::
NUMBER OF EVENTS: 32

EV ID		BIAS	BIASD	DRIFT	C	LAT	LONG	ANG	MAJOR	MINOR	PR	CL	SRR	CTA
08900	A	.2	0.0	0.00	3	4740.6N	05304.1W	049	2.300	2.100	97	AC	HA02	11.765
F:4	B	.2	2.0	0.00	3	5430.5N	01750.6W	277	5.900	2.900	03	IM	UK01	-11.20

R/G:G ITR:6 CNF:3 S:9 PWR:3837 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 212714Z95 LOS:345 214221Z95 XMT:345 214559Z95 ST:RDNDNT CASE:00000 000
SRC:3161 M:23576 SC:004 OB:37186 A RS: 1.0 TR:25.0 X:N TCA:345 195239Z95 W:I
PTS 012 TPC:345 2146Z95 R2EV:08831 B RS: 2.0 TR:25.0 X:N TCA:345 195239Z95 W:I
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 4740N/LNG 05300W/:::/:::/:::/:::/::

08914	A	.2	0.0	0.00	3	4740.5N	05304.3W	061	2.300	2.100	98	AC	HA02	11.768
F:4	B	.2	3.0	0.00	3	5431.4N	01755.5W	085	11.50	5.300	02	IM	UK01	-11.16

R/G:G ITR:6 CNF:3 S:9 PWR:3458 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 213608Z95 LOS:345 214413Z95 XMT:345 214636Z95 ST:RDNDNT CASE:00000 000
SRC:3163 M:34923 SC:004 OB:37186 A RS: 1.0 TR:25.0 X:N TCA:345 195239Z95 W:I
PTS 014 TPC:345 2149Z95 R2EV:08831 B RS: 6.0 TR:25.0 X:N TCA:345 195240Z95 W:I
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 4740N/LNG 05300W/:::/:::/:::/:::/::

08836	A	.2	0.0	0.00	3	4740.5N	05304.3W	061	2.300	2.100	98	AC	HA02	11.768
F:4	B	.2	3.0	0.00	3	5431.4N	01755.6W	085	11.50	5.300	02	IM	UK01	-11.16

R/G:G ITR:6 CNF:3 S:9 PWR:3458 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 195433Z95 LOS:345 200453Z95 XMT:345 200648Z95 ST:RDNDNT CASE:00000 000
SRC:3162 M:13240 SC:004 OB:37185 A RS: 1.0 TR:25.0 X:N TCA:345 195239Z95 W:I
PTS 014 TPC:345 2101Z95 R2EV:08831 B RS: 6.0 TR:25.0 X:N TCA:345 195240Z95 W:I
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 4740N/LNG 05300W/:::/:::/:::/:::/::

08831	A	.2	0.0	0.00	3	4740.5N	05304.3W	061	2.300	2.100	98	AC	HA02	11.768
F:4	B	.2	3.0	0.00	3	5431.4N	01755.5W	085	11.50	5.300	02	IM	UK01	-11.16

R/G:G ITR:6 CNF:3 S:9 PWR:3458 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 194802Z95 LOS:345 200123Z95 XMT:345 200403Z95 ST:CONFRM CASE:55797 008
SRC:3161 M:23563 SC:004 OB:37185 A RS: 1.0 TR:25.0 X:N TCA:345 195239Z95 W:I
PTS 014 TPC:345 2023Z95 R2EV:00000 B RS: 6.0 TR:25.0 X:N TCA:345 195240Z95 W:I
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT 4740N/LNG 05300W/:::/:::/:::/:::/::

08943	A	.3	0.0	0.00	3	4740.5N	05303.2W	048	2.100	2.000	83	AC	HA02	11.757
F:4	B	.0	1.0	0.00	3	5442.2N	01729.3W	277	3.300	2.000	17	IM	UK01	-11.42

R/G:G ITR:1 CNF:3 S:9 PWR:0917 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 231103Z95 LOS:345 232609Z95 XMT:345 232944Z95 ST:RDNDNT CASE:00000 000
SRC:3162 M:13264 SC:004 OB:37187 A RS: 1.0 TR:25.0 X:N TCA:345 195239Z95 W:O
PTS 004 TPC:345 2330Z95 R2EV:08831 B RS: 1.0 TR:25.0 X:N TCA:345 195243Z95 W:O
FF 1/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00

F 2.5

```
08780 A   .3   1.0   0.00 4 4741.6N 05257.7W 283 3.000 2.200 98 AC HA02 -12.27
F:4   B   .3   3.0   0.00 4 5103.5N 09143.0W 271 12.70 5.400 02 IM TR01 12.989
R/G:G ITR:6  CNF:4 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 185510Z95 LOS:345 191023Z95 XMT:345 191343Z95 ST:RDNDNT CASE:00000 000
SRC:3162 M:13228  SC:106 OB:23817  A RS: 1.0 TR:25.0 X:N TCA:345 190034Z95 W:I
PTS 012 TPC:345 1914Z95 R2EV:08762 B RS: 4.0 TR:25.0 X:N TCA:345 190033Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08762 A   .3   1.0   0.00 4 4741.5N 05257.7W 283 3.100 2.200 98 AC HA02 -12.27
F:4   B   .3   3.0   0.00 4 5103.5N 09143.0W 271 12.70 5.400 02 IM TR01 12.989
R/G:G ITR:6  CNF:4 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 185752Z95 LOS:345 190651Z95 XMT:345 190924Z95 ST:CONFRM CASE:55797 007
SRC:3163 M:34894  SC:106 OB:23817  A RS: 1.0 TR:25.0 X:N TCA:345 190034Z95 W:I
PTS 012 TPC:345 1910Z95 R2EV:00000 B RS: 4.0 TR:25.0 X:N TCA:345 190033Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08828 A   .3   1.0   0.00 4 4741.3N 05258.2W 059 2.700 2.200 94 AC HA02 -12.26
F:4   B   .4   6.6   0.00 4 5053.7N 09207.2W 316 34.40 19.30 06 IM TR01 13.264
R/G:G ITR:1  CNF:4 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 203803Z95 LOS:345 205405Z95 XMT:345 205950Z95 ST:RDNDNT CASE:00000 000
SRC:3163 M:34910  SC:106 OB:23818  A RS: 1.0 TR:25.0 X:N TCA:345 190034Z95 W:I
PTS 008 TPC:345 2106Z95 R2EV:08762 B RS:14.0 TR:25.0 X:N TCA:345 190031Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08853 A   .3   1.0   0.00 4 4741.3N 05258.2W 059 2.700 2.200 94 AC HA02 -12.26
F:4   B   .4   6.6   0.00 4 5053.7N 09207.2W 316 34.40 19.30 06 IM TR01 13.264
R/G:G ITR:1  CNF:4 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 203803Z95 LOS:345 205405Z95 XMT:345 205752Z95 ST:RDNDNT CASE:00000 000
SRC:3163 M:34910  SC:106 OB:23818  A RS: 1.0 TR:25.0 X:N TCA:345 190034Z95 W:I
PTS 008 TPC:345 2103Z95 R2EV:08762 B RS:14.0 TR:25.0 X:N TCA:345 190031Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08794 A   .3   1.0   0.00 4 4741.2N 05257.6W 283 3.000 2.200 99 AC HA02 -12.27
F:4   B   .3   3.0   0.00 4 5103.2N 09143.0W 271 12.80 5.400 01 IM TR01 12.991
R/G:R ITR:6  CNF:4 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 185310Z95 LOS:345 191005Z95 XMT:345 191344Z95 ST:RDNDNT CASE:00000 000
SRC:3161 M:23557  SC:106 OB:23817  A RS: 1.0 TR:25.0 X:N TCA:345 190034Z95 W:I
PTS 012 TPC:345 1915Z95 R2EV:08762 B RS: 4.0 TR:25.0 X:N TCA:345 190033Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08874 A   .3   1.0   0.00 4 4741.2N 05258.2W 289 3.600 2.300 99 AC HA02 -12.26
F:4   B   .3   2.0   0.00 4 5103.6N 09140.2W 086 9.400 4.100 01 IM TR01 12.959
R/G:G ITR:5  CNF:4 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 203912Z95 LOS:345 205619Z95 XMT:345 205928Z95 ST:RDNDNT CASE:00000 000
SRC:3162 M:13246  SC:106 OB:23818  A RS: 1.0 TR:25.0 X:N TCA:345 190034Z95 W:I
PTS 011 TPC:345 2104Z95 R2EV:08762 B RS: 3.0 TR:25.0 X:N TCA:345 190033Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08862 A   .3   1.0   0.00 4 4741.0N 05257.8W 283 3.100 2.200 99 AC HA02 -12.27
F:4   B   .3   3.0   0.00 4 5102.9N 09142.9W 271 12.90 5.500 01 IM TR01 12.990
R/G:G ITR:6  CNF:4 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 204217Z95 LOS:345 205533Z95 XMT:345 205805Z95 ST:RDNDNT CASE:00000 000
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P 5.4

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FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08832 A   .2   5.0   0.00 3 4742.9N 05301.9W 295 10.80 3.100 78 AC HA02 24.707
F:4   B   .1   6.6   0.00 3 6317.4N 03228.9E 037 27.90 7.400 22 IM RU01 -22.31
R/G:G ITR:1  CNF:3 S:9 PWR:2083 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 194802Z95 LOS:345 200123Z95 XMT:345 200403Z95 ST:RDNDNT CASE:00000 000
SRC:3161 M:23563  SC:004 OB:37185  A RS: 1.0 TR:25.0 X:N TCA:345 181351Z95 W:I
PTS 006 TPC:345 2023Z95 R2EV:08733 B RS: 2.0 TR:25.0 X:N TCA:345 181357Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08915 A   .3   5.0   0.00 3 4741.8N 05257.4W 311 9.700 3.900 83 AC HA02 24.689
F:4   B   .2   6.6   0.00 3 6306.4N 03207.8E 019 35.70 14.00 17 IM RU01 -22.23
R/G:G ITR:1  CNF:3 S:9 PWR:1820 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 213608Z95 LOS:345 214413Z95 XMT:345 214636Z95 ST:RDNDNT CASE:00000 000
SRC:3163 M:34923  SC:004 OB:37186  A RS: 1.0 TR:25.0 X:N TCA:345 181350Z95 W:I
PTS 007 TPC:345 2149Z95 R2EV:08733 B RS: 5.0 TR:25.0 X:N TCA:345 181353Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08742 A   .3   5.0   0.00 3 4741.8N 05257.4W 311 9.700 3.900 83 AC HA02 24.689
F:4   B   .2   6.6   0.00 3 6306.3N 03207.8E 019 35.80 14.00 17 IM RU01 -22.23
R/G:G ITR:1  CNF:3 S:9 PWR:1820 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 181702Z95 LOS:345 182552Z95 XMT:345 182809Z95 ST:RDNDNT CASE:00000 000
SRC:3162 M:13223  SC:004 OB:37184  A RS: 1.0 TR:25.0 X:N TCA:345 181350Z95 W:I
PTS 007 TPC:345 1828Z95 R2EV:08733 B RS: 6.0 TR:25.0 X:N TCA:345 181353Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08733 A   .3   5.0   0.00 3 4741.8N 05257.3W 311 9.700 3.900 83 AC HA02 24.689
F:4   B   .2   6.6   0.00 3 6306.3N 03207.8E 019 35.70 14.00 17 IM RU01 -22.23
R/G:G ITR:1  CNF:3 S:9 PWR:1823 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 181146Z95 LOS:345 182004Z95 XMT:345 182254Z95 ST:CONFRM CASE:55797 006
SRC:3161 M:23552  SC:004 OB:37184  A RS: 1.0 TR:25.0 X:N TCA:345 181350Z95 W:I
PTS 007 TPC:345 1823Z95 R2EV:00000 B RS: 5.0 TR:25.0 X:N TCA:345 181353Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08725 A  4.9   0.0   0.00 3 4056.5N 08811.5W 068 2.400 2.000 84 IM US01 13.381
F:4   B  5.0   2.0   0.00 3 4743.8N 05239.8W 083 6.400 2.100 16 AC HA02 -12.75
R/G:R ITR:1  CNF:3 S:9 PWR:2655 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 174951Z95 LOS:345 180430Z95 XMT:345 180858Z95 ST:CONFRM CASE:55797 005
SRC:3161 M:23545  SC:006 OB:04886  A RS: 1.0 TR:25.0 X:N TCA:345 175526Z95 W:O
PTS 004 TPC:345 1809Z95 R2EV:00000 B RS: 1.0 TR:25.0 X:N TCA:345 175524Z95 W:O
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/MAN/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08715 A   .3   2.0   0.00 4 4742.6N 05258.2W 053 4.400 2.300 86 AC HA02 -23.57
F:4   B   .4   6.6   0.00 4 5334.8N 13533.2W 317 33.80 8.800 14 IM VI06 26.332
R/G:R ITR:1  CNF:4 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 174150Z95 LOS:345 175906Z95 XMT:345 180355Z95 ST:RDNDNT CASE:00000 000
SRC:3162 M:13217  SC:104 OB:32281  A RS: 1.0 TR:25.0 X:N TCA:345 175028Z95 W:I
PTS 011 TPC:345 1804Z95 R2EV:08705 B RS: 3.0 TR:25.0 X:N TCA:345 175020Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08705 A   .3   2.0   0.00 4 4742.6N 05258.0W 053 4.400 2.300 87 AC HA02 -23.57
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AOS:345 174125Z95 LOS:345 175643Z95 XMT:345 180108Z95 ST:CONFRM CASE:55797 004
SRC:3163 M:34883  SC:104 OB:32281  A RS: 1.0 TR:25.0 X:N TCA:345 175028Z95 W:I
PTS 011 TPC:345 1801Z95 R2EV:00000 B RS: 3.0 TR:25.0 X:N TCA:345 175020Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08781 A   .2   6.6   0.00 1 4642.3N 03833.7W 306 999.9 46.40 50 IM HA02 -4.800
F:4   B   .3   6.6   0.00 1 4756.9N 05236.1W 068 999.9 47.70 50 AC HA02  4.818
R/G:G ITR:3  CNF:1 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 185510Z95 LOS:345 191023Z95 XMT:345 191343Z95 ST:RDNDNT CASE:00000 000
SRC:3162 M:13228  SC:106 OB:23817  A RS: 1.0 TR:25.0 X:N TCA:345 171439Z95 W:O
PTS 003 TPC:345 1914Z95 R2EV:08682 B RS: 1.0 TR:25.0 X:N TCA:345 171438Z95 W:O
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08682 A   .2   6.6   0.00 1 4642.2N 03833.2W 306 999.9 46.40 50 IM HA02 -4.806
F:4   B   .3   6.6   0.00 1 4756.8N 05236.6W 068 999.9 47.70 50 AC HA02  4.823
R/G:R ITR:3  CNF:1 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 171522Z95 LOS:345 172327Z95 XMT:345 172501Z95 ST:CONFRM CASE:55797 003
SRC:3162 M:13211  SC:106 OB:23816  A RS: 1.0 TR:25.0 X:N TCA:345 171439Z95 W:O
PTS 003 TPC:345 1725Z95 R2EV:00000 B RS: 1.0 TR:25.0 X:N TCA:345 171438Z95 W:O
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08689 A   .2   6.6   0.00 1 4641.7N 03832.2W 306 999.9 46.40 50 IM HA02 -4.818
F:4   B   .3   6.6   0.00 1 4756.5N 05237.6W 068 999.9 47.70 50 AC HA02  4.835
R/G:R ITR:3  CNF:1 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 170808Z95 LOS:345 172411Z95 XMT:345 172558Z95 ST:RDNDNT CASE:00000 000
SRC:3161 M:23538  SC:106 OB:23816  A RS: 1.0 TR:25.0 X:N TCA:345 171439Z95 W:O
PTS 003 TPC:345 1726Z95 R2EV:08682 B RS: 1.0 TR:25.0 X:N TCA:345 171438Z95 W:O
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08763 A   .3   6.6   0.00 1 4757.0N 05235.6W 068 999.9 47.70 50 AC HA02  4.813
F:4   B   .2   6.6   0.00 1 4642.5N 03834.1W 306 999.9 46.40 50 IM HA02 -4.795
R/G:G ITR:3  CNF:1 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 185752Z95 LOS:345 190651Z95 XMT:345 190924Z95 ST:RDNDNT CASE:00000 000
SRC:3163 M:34894  SC:106 OB:23817  A RS: 1.0 TR:25.0 X:N TCA:345 171438Z95 W:O
PTS 003 TPC:345 1910Z95 R2EV:08682 B RS: 1.0 TR:25.0 X:N TCA:345 171439Z95 W:O
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08795 A   .3   6.6   0.00 1 4756.6N 05237.0W 068 999.9 47.70 50 AC HA02  4.829
F:4   B   .2   6.6   0.00 1 4641.9N 03832.7W 306 999.9 46.40 50 IM HA02 -4.812
R/G:G ITR:3  CNF:1 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 185310Z95 LOS:345 191005Z95 XMT:345 191344Z95 ST:RDNDNT CASE:00000 000
SRC:3161 M:23557  SC:106 OB:23817  A RS: 1.0 TR:25.0 X:N TCA:345 171438Z95 W:O
PTS 003 TPC:345 1915Z95 R2EV:08682 B RS: 1.0 TR:25.0 X:N TCA:345 171439Z95 W:O
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::::/:::/::/::

08674 A   .2   3.0   0.00 3 4743.1N 05300.7W 057 6.600 2.900 83 AC HA02 24.048
F:4   B   .3   6.6   0.00 3 6226.2N 13449.8W 332 24.40 9.100 17 IM VI02 -21.71
R/G:R ITR:1  CNF:3 S:9 PWR:0610 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 163321Z95 LOS:345 164825Z95 XMT:345 165318Z95 ST:RDNDNT CASE:00000 000
SRC:3162 M:13205  SC:002 OB:56699  A RS: 1.0 TR:25.0 X:N TCA:345 163943Z95 W:I
PTS 008 TPC:345 1654Z95 R2EV:08659 B RS: 4.0 TR:25.0 X:N TCA:345 163939Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/MAN/00
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P3.6

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08659 A   .3   3.0   0.00 3 4743.4N 05259.3W 055 6.500 2.800 84 AC HA02 24.058
F:4   B   .4   6.6   0.00 3 6227.8N 13452.0W 334 24.00 9.000 16 IM VI02 -21.72
R/G:R ITR:1  CNF:3 S:9 PWR:0527 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 163341Z95 LOS:345 164531Z95 XMT:345 164827Z95 ST:CONFRM CASE:55797 002
SRC:3161 M:23532  SC:002 OB:56699  A RS: 1.0 TR:25.0 X:N TCA:345 163943Z95 W:I
PTS 007 TPC:345 1648Z95 R2EV:00000 B RS: 4.0 TR:25.0 X:N TCA:345 163938Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/MAN/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::/:::/:::/::

08690 A  -.0   6.6   0.00 1 4322.6N 01022.2E 072 356.2 37.60 50 IM IT01 -20.87
F:4   B   .3   6.6   0.00 1 4740.7N 05257.3W 298 433.0 44.00 50 AC HA02 22.605
R/G:G ITR:3  CNF:1 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 170808Z95 LOS:345 172411Z95 XMT:345 172558Z95 ST:RDNDNT CASE:00000 000
SRC:3161 M:23538  SC:106 OB:23816  A RS: 1.0 TR:25.0 X:N TCA:345 153036Z95 W:I
PTS 003 TPC:345 1726Z95 R2EV:08643 B RS: 1.0 TR:25.0 X:N TCA:345 153022Z95 W:O
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::/:::/:::/::

08683 A   .3   6.6   0.00 1 4740.8N 05257.5W 298 433.2 44.00 50 AC HA02 22.606
F:4   B  -.0   6.6   0.00 1 4322.7N 01022.1E 071 356.2 37.70 50 IM IT01 -20.87
R/G:G ITR:3  CNF:1 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 171522Z95 LOS:345 172327Z95 XMT:345 172501Z95 ST:RDNDNT CASE:00000 000
SRC:3162 M:13211  SC:106 OB:23816  A RS: 1.0 TR:25.0 X:N TCA:345 153022Z95 W:O
PTS 003 TPC:345 1725Z95 R2EV:08643 B RS: 1.0 TR:25.0 X:N TCA:345 153036Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::/:::/:::/::

08764 A   .3   6.6   0.00 1 4740.8N 05257.4W 298 433.1 44.00 50 AC HA02 22.605
F:4   B  -.0   6.6   0.00 1 4322.7N 01022.1E 071 356.2 37.70 50 IM IT01 -20.87
R/G:G ITR:3  CNF:1 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 185752Z95 LOS:345 190651Z95 XMT:345 190924Z95 ST:RDNDNT CASE:00000 000
SRC:3163 M:34894  SC:106 OB:23817  A RS: 1.0 TR:25.0 X:N TCA:345 153022Z95 W:O
PTS 003 TPC:345 1910Z95 R2EV:08643 B RS: 1.0 TR:25.0 X:N TCA:345 153036Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::/:::/:::/::

08643 A   .3   6.6   0.00 1 4740.8N 05257.3W 298 433.1 44.00 50 AC HA02 22.605
F:4   B  -.0   6.6   0.00 1 4322.7N 01022.3E 072 356.1 37.60 50 IM IT01 -20.87
R/G:R ITR:3  CNF:1 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 152759Z95 LOS:345 153655Z95 XMT:345 153907Z95 ST:CONFRM CASE:55797 001
SRC:3161 M:23520  SC:106 OB:23815  A RS: 1.0 TR:25.0 X:N TCA:345 153022Z95 W:O
PTS 003 TPC:345 1539Z95 R2EV:00000 B RS: 1.0 TR:25.0 X:N TCA:345 153036Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::/:::/:::/::

08622 A   .3   1.0   0.00 3 4742.2N 05302.2W 298 2.700 2.200 98 AC HA02 10.729
F:4   B   .3   3.0   0.00 3 5347.2N 08453.3W 275 8.600 4.200 02 IM TR01 -10.20
R/G:R ITR:5  CNF:3 S:9 PWR:2516 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 145234Z95 LOS:345 150725Z95 XMT:345 151112Z95 ST:CONFRM CASE:55797 000
SRC:3161 M:23515  SC:002 OB:56698  A RS: 1.0 TR:25.0 X:N TCA:345 150051Z95 W:I
PTS 014 TPC:345 1511Z95 R2EV:00000 B RS: 5.0 TR:25.0 X:N TCA:345 150050Z95 W:I
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/MAN/00
HEX A79D0 14ED9 40401/LAT :::::/LNG :::::::/:::/:::/:::/:::/::

08606 A   .3   1.0   0.00 4 4741.6N 05303.3W 069 3.100 2.200 97 AC HA02  9.666
F:4   B   .2   2.0   0.00 4 4523.4N 02548.3W 304 6.600 3.200 03 IM UK01 -9.185
R/G:R ITR:7  CNF:4 S:9 PWR:9999 SB:00 SWP:0000 SWD:099 TY:EL CLT:001 000000Z80
AOS:345 141133Z95 LOS:345 142652Z95 XMT:345 142938Z95 ST:CONFRM CASE:55797 000
```

1 of 1

FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT ::::::/LNG :::::::/:::::/:::::/:::::/:::/::

NUMBER OF U406S : 1

U4 ID	SRC	MSGNM	MSG RCVD TIME	SAT	ORBNM	TCA
16546	3165	3	345 162400Z95	208	0	345 162454Z95

STATUS: RDNDNT TPC: 345 1625Z95 CLT: 345 1649Z95 PTS: 1
FF 0/PF 1/CC 316/UC TST/ID UNKNOWN/MODEL TST/HS 121/NU/AUT/00
HEX A79D0 14ED9 40401/LAT ::::::/LNG :::::::/:::::/:::::/:::::/:::/::

Only 1 Goes Hit because System was down most of this period

DATABASE MAINTENANCE - QUERY
AUX ALERT DATABASE QUERY

System Manager report for printer.

SUBJECT TYPE - CASE/EVENT/UNLOCATED 406 (C/E/U): C,E
CONDITIONS
TCA START: 345 1345Z95 END: 345 2040Z95 OR LAST HRS MINS
FREQ: 1 2 3 BIAS RANGE: LOW: KHz HIGH: KHz
GEOGRAPHY - CENTER RADIUS OR CENTER BOX OR FLIGHT PATH (R/B/P): R
LOCATION1: LAT 4742.0N LONG 05259.4W WIDTH 200 Naut. mi.
LOCATION2: LAT LONG LENGTH Naut. mi.
BEACON ID: COUNTRY CODE: PROTOCOL FLAG:
^ ^ REAL DATA/GLOBAL DATA/BOTH (R/G/B):
SRR: SATELLITES:
SOURCES: ORBIT NUMBER:
STATUS:
CONFIDENCE: USER CLASS: (PROTOCOL FLAG=1 ONLY)
SIGNAL TYPE - ELT/INTERFERER/UNKNOWN (EL/IR/UN):
DESTINATIONS:
TRANSMIT TIME START: END:

Distance between GPS coord & case (121.5) 55 78
is 8800 meters

p 4.7

CMCC QUERY REPORT DATABASE: AUXILIARY 120 1539Z96
NUMBER OF CASES : 1

CS ID	REV	F	BIAS	BIASD	LAT	LONG	ANG	MAJOR	MINOR	CC	CL	SRR	TY	S	PWR
55798	3	1	-.3	6.5	4740.8N	05306.3W	56	4.412	3.779	4	TE	HA02	UN	2	13

R/G:R SWP:0308 SWD:099 FMT:345 141724Z95 UPT:345 190034Z95 CLT:346 031050Z95
CNF:3 ST:AGED M2CS: 0000 000
NUMBER OF EVENTS: 12

EV ID		BIAS	BIASD	DRIFT	C	LAT	LONG	ANG	MAJOR	MINOR	PR	CL	SRR	CTA
08828	A	-.4	3.0	0.00	3	4754.8N	05205.6W	318	14.40	10.80	72	PR	HA02	11.078
F:1	B	-.5	4.0	0.00	3	5421.9N	01919.1W	010	14.50	11.10	28	SC	UK01	-10.33

R/G:R ITR:9 CNF:3 S:4 PWR:0023 SB:00 SWP:0000 SWD:099 TY:UN CLT:346 041000Z95
AOS:345 194802Z95 LOS:345 200123Z95 XMT:345 200403Z95 ST:AGED CASE:00000 000
SRC:3161 M:23563 SC:004 OB:37185 A RS:17.0 TR:25.0 X:N TCA:345 195237Z95 W:I
PTS 099 TPC:345 2023Z95 R2EV:00000 B RS:19.0 TR:25.0 X:N TCA:345 195238Z95 W:I

08826	A	-.2	16.4	0.00	1	4709.0N	05255.7W	037	300.2	53.00	50	PR	HA02	11.688
F:1	B	-.2	16.4	0.00	1	5348.7N	01724.6W	291	999.9	999.9	50	SC	UK01	11.688

R/G:R ITR:0 CNF:1 S:0 PWR:0000 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
AOS:001 000000Z80 LOS:001 000000Z80 XMT:345 195500Z95 ST:SUPPRS CASE:00000 000
SRC:2241 M:55075 SC:004 OB:00000 A RS:14.0 TR:52.3 X:N TCA:345 195229Z95 W:O
PTS 000 TPC:345 2012Z95 R2EV:00000 B RS:14.0 TR:36.8 X:N TCA:345 195229Z95 W:O

08756	A	-.3	6.6	0.00	2	4743.7N	05310.9W	323	53.80	23.60	50	AC	HA02	-12.12
F:1	B	-.3	6.6	0.00	2	5104.2N	09124.4W	050	58.60	25.80	50	IM	TR01	12.794

R/G:R ITR:1 CNF:2 S:2 PWR:0013 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
AOS:345 185752Z95 LOS:345 190651Z95 XMT:345 190924Z95 ST:CONFRM CASE:55798 003
SRC:3163 M:34894 SC:106 OB:23817 A RS:17.0 TR:25.0 X:N TCA:345 190034Z95 W:I
PTS 099 TPC:345 1910Z95 R2EV:00000 B RS:17.0 TR:25.0 X:N TCA:345 190033Z95 W:I

08775	A	-.3	4.0	0.00	2	4737.1N	05311.6W	312	33.30	14.80	50	AC	HA02	-12.15
F:1	B	-.3	4.0	0.00	2	5056.5N	09131.9W	061	38.10	17.30	50	IM	TR01	12.888

R/G:R ITR:1 CNF:2 S:2 PWR:0013 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
AOS:345 185510Z95 LOS:345 191023Z95 XMT:345 191343Z95 ST:RDNDNT CASE:00000 000
SRC:3162 M:13228 SC:106 OB:23817 A RS:16.0 TR:25.0 X:N TCA:345 190032Z95 W:I
PTS 099 TPC:345 1914Z95 R2EV:08756 B RS:17.0 TR:25.0 X:N TCA:345 190031Z95 W:I

08787	A	-.3	2.0	0.00	2	4736.3N	05311.4W	298	27.50	12.20	50	AC	HA02	-12.16
F:1	B	-.3	2.0	0.00	2	5054.3N	09131.9W	076	30.60	13.90	50	IM	TR01	12.894

R/G:R ITR:1 CNF:2 S:2 PWR:0013 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
AOS:345 185310Z95 LOS:345 191005Z95 XMT:345 191344Z95 ST:RDNDNT CASE:00000 000
SRC:3161 M:23557 SC:106 OB:23817 A RS:16.0 TR:25.0 X:N TCA:345 190032Z95 W:I
PTS 099 TPC:345 1915Z95 R2EV:08756 B RS:17.0 TR:25.0 X:N TCA:345 190030Z95 W:I

08772	A	-.1	22.5	0.00	2	4648.5N	05159.6W	327	61.70	12.40	50	PR	HA02	13.655
F:1	B	-.1	22.5	0.00	2	5025.0N	09319.8W	045	68.40	13.80	50	SC	TR01	13.655

R/G:R ITR:0 CNF:2 S:0 PWR:0000 SB:00 SWP:0000 SWD:099 TY:UN CLT:346 031050Z95
AOS:001 000000Z80 LOS:001 000000Z80 XMT:345 191100Z95 ST:AGED CASE:00000 000
SRC:3661 M:31991 SC:106 OB:00000 A RS:13.8 TR: 1.4 X:N TCA:345 190024Z95 W:I
PTS 000 TPC:345 1913Z95 R2EV:00000 B RS:13.8 TR: 1.1 X:N TCA:345 190024Z95 W:I

08718	A	-.1	3.0	0.00	3	4736.8N	05256.0W	285	29.00	14.40	50	AC	HA02	-12.57
F:1	B	-.1	3.0	0.00	3	4045.3N	08745.1W	044	30.40	15.60	50	IM	US01	13.169

R/G:R ITR:2 CNF:3 S:2 PWR:0012 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80

```
PTS 099 TPC:345 1809Z95 R2EV:00000 B RS:18.0 TR:25.0 X:N TCA:345 175521Z95 W:I

08694 A -1.3  58.4   0.00 1 4742.2N 05542.4W 004 176.2 29.30 50 PR HA02 23.274
F:1   B -1.3  58.4   0.00 1 5353.9N 13212.2W 005 225.2 34.60 50 SC VI06 23.274
R/G:R ITR:0  CNF:1 S:0 PWR:0000 SB:00 SWP:0319 SWD:099 TY:UN CLT:001 000000Z80
AOS:001 000000Z80 LOS:001 000000Z80 XMT:345 175900Z95 ST:SUPPRS CASE:00000 000
SRC:3661 M:31989  SC:104 OB:00000  A RS:14.4 TR: 1.8 X:N TCA:345 175006Z95 W:I
PTS 000 TPC:345 1800Z95 R2EV:00000 B RS:14.3 TR: 1.9 X:N TCA:345 175006Z95 W:I

08645 A  -.3   3.3   0.00 4 4741.0N 05314.5W 045 6.100 5.700 50 AC HA02  8.118
F:1   B  -.3   3.3   0.00 4 4948.2N 07740.3W 340 6.400 5.900 50 IM TR01  8.118
R/G:R ITR:0  CNF:2 S:0 PWR:0000 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
AOS:001 000000Z80 LOS:001 000000Z80 XMT:345 161500Z95 ST:CONFRM CASE:55798 001
SRC:3666 M:31987  SC:104 OB:00000  A RS:13.7 TR:  .2 X:N TCA:345 160254Z95 W:I
PTS 000 TPC:345 1617Z95 R2EV:00000 B RS:13.3 TR:  .2 X:N TCA:345 160254Z95 W:I

08638 A  -.5   3.7   0.00 3 4743.9N 05255.4W 046 7.800 5.500 50 AC HA02 10.435
F:1   B  -.5   3.7   0.00 4 5359.5N 08440.1W 347 6.800 4.900 50 IM TR01 10.435
R/G:R ITR:0  CNF:2 S:0 PWR:0000 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
AOS:001 000000Z80 LOS:001 000000Z80 XMT:345 151900Z95 ST:CONFRM CASE:55798 000
SRC:3666 M:31985  SC:002 OB:00000  A RS:14.0 TR: 0.0 X:N TCA:345 150048Z95 W:I
PTS 000 TPC:345 1521Z95 R2EV:00000 B RS:13.6 TR:  .8 X:N TCA:345 150048Z95 W:I

08604 A  -.3   3.0   0.00 2 4738.8N 05311.5W 270 29.30 14.30 95 AC HA02  9.761
F:1   B  -.3   3.0   0.00 2 4520.2N 02543.6W 283 27.90 13.30 05 IM UK01 -9.253
R/G:R ITR:2  CNF:2 S:3 PWR:0015 SB:00 SWP:0000 SWD:099 TY:UN CLT:001 000000Z80
AOS:345 141133Z95 LOS:345 142652Z95 XMT:345 142938Z95 ST:CONFRM CASE:55798 000
SRC:3161 M:23508  SC:104 OB:32279  A RS:19.0 TR:25.0 X:N TCA:345 141724Z95 W:I
PTS 099 TPC:345 1430Z95 R2EV:00000 B RS:19.0 TR:25.0 X:N TCA:345 141725Z95 W:I

08827 A  -.1  21.0  -2.62 3 4734.3N 05303.2W 195 60.50 24.90 50 AC HA02  9.673
F:1   B  -.1  21.0  -2.62 3 4517.8N 02549.8W 178 55.60 23.70 50 IM UK01  9.673
R/G:R ITR:2  CNF:3 S:0 PWR:0000 SB:00 SWP:0308 SWD:099 TY:UN CLT:001 000000Z80
AOS:001 000000Z80 LOS:001 000000Z80 XMT:345 195600Z95 ST:RDNDNT CASE:00000 000
SRC:2271 M:55076  SC:104 OB:00000  A RS: 8.4 TR: 2.1 X:N TCA:345 141723Z95 W:I
PTS 000 TPC:345 2017Z95 R2EV:08604 B RS: 8.4 TR: 2.2 X:N TCA:345 141723Z95 W:I
```

APPENDIX D

Other Fax information from Oceans Ltd., Dated April 22, 1996 and May 13, 1996.

Oceans LTD. Fax Message

To: Al Coppin		Fax Number(s): (604) 293-5754
Company: MPR Teltech		From: Gordon Breen
Date: 22 April 1996	Time(NST):	Fax: (709) 753-3301 Voice: (709) 753-5788 e-mail: oceans@terra.nlnet.nf.ca cbreen@gill.ifmt.nf.ca
Subject: GPS EPIRB Tests		Number of Pages (Include Cover): 1
CC:		CC Fax Number(s):

Dear Al,

Corrections to the report are listed below:

1. The DGPS coordinates for 1731 Z are 47°35.458'N, 52°27.449'W.

2. At 1823 Z the position listed is the approximate location of the Virgin Rocks. The crew of the CCGS Sir Humphrey Gilbert was informed of the distress signal by radio by the rescue co-ordination centres in Halifax and St. John's. I do not have an exact record of the position given to the crew, except that it was "just south of the Virgin Rocks." The position of the distress signal received by CMCC Trenton at this time should be recorded in the archived satellite data. Otherwise, I should be able to retrieve it from the ship's log. It may also be helpful to know that the location of the vessel/EPIRB at 1820 Z time was 47°37' N, 52°14" W.

If I can be of further assistance, please give me a call.

Regards

Gord Breen

Oceans LTD. Fax Message

To: Al Coppin		Fax Number(s): (604) 293-5754
Company: MPR Teltech		From: Gordon Breen
Date: 13 May 1996	Time(NST): 18:40	Fax: (709) 753-3301 Voice: (709) 753-5788 e-mail: oceans@terra.nlnet.nf.ca cbreen@gill.ifmt.nf.ca
Subject: GPS EPIRB Sea Trials / Presentation Mat'ls		Number of Pages (Include Cover): 4
CC:		CC Fax Number(s):

Dear Al,

Comments related to your May 7th fax are included below. I have also attached additional position data for the CCGS Sir Humphrey Gilbert and experiment liferaft which you may find useful. This data was obtained from the experiment data (GPS receivers separate from the ship's DGPS system; experiment target detection logs; etc.) and by interpolation. Positions of interested are shown in "bold" type face. If you want, I can explain in greater detail how this data was obtained over the phone. Give me a call if you have further questions.

Comments on Presentation Materials (*noaa1996.wsp*):

Test Plan Objectives, Phase 6, page 3: replace "affect" with "effect."

Phase 1, page 4, 1358Z: I was referring to an external 12V battery supplied by OCEANS Ltd. (i.e., the mounting bracket was powered by an external power supply).

Phase 2, page 6, note on 121.5 MHz data: I have no explanation for this except that the EPIRB was set to MANUAL ON for about 10-20 seconds at 1654Z. Does this observation correspond to the time of the unexplained 121.5 MHz data?

Phase 3, page 8, 1654Z: EPIRB and ship DGPS position and heading observations were recorded about 30 seconds apart (displays were not in the same location on the ship).

Phase 4, page 9, 1720-1823Z: See attached sheets for additional position data.

Phase 4, Satellite Location Results, Section B., page 10: Should this read "No 121.5 MHz signals received during this period were recorded"?

Phase 5, page 12, 1345Z: Liferaft deployment position noted in the report for 1345Z should read 47°41.64'N, 53°04.32'W.

Phase 5, Satellite Location Results, Section A., page 13: See attached sheets for additional position data.

Phase 5, Satellite Location Results, Sections B. and D., page 15: See attached sheets for additional liferaft position data.

Phase 6, Satellite Location Results, page 16: See attached sheets for additional vessel/EPIRB position data.

Hope this is helpful.

Regards,

Gord.

GILBERT POSITION DATA (GPS AND INTERPOLATED)															
Date	Julian Day	Time (UTC)		N	W	N					W				
6-Dec-96	340	17:25		47.586	52.501	47	°	35.2	'		52	°	30.0	'	
6-Dec-96	340	17:27	*	47.587	52.492	47	°	35.2	'		52	°	29.5	'	
6-Dec-96	340	17:30		47.588	52.478	47	°	35.3	'		52	°	28.7	'	
6-Dec-96	340	17:50		47.600	52.387	47	°	36.0	'		52	°	23.2	'	
6-Dec-96	340	18:20		47.619	52.247	47	°	37.2	'		52	°	14.8	'	
6-Dec-96	340	18:21	*	47.619	52.243	47	°	37.1	'		52	°	14.6	'	
6-Dec-96	340	18:25		47.617	52.227	47	°	37.0	'		52	°	13.6	'	
11-Dec-96	345	13:45		47.694	53.073	47	°	41.7	'		53	°	4.4	'	
11-Dec-96	345	14:15		47.647	53.112	47	°	38.8	'		53	°	6.7	'	
11-Dec-96	345	14:17	*	47.650	53.112	47	°	39.0	'		53	°	6.7	'	
11-Dec-96	345	14:20		47.654	53.113	47	°	39.3	'		53	°	6.8	'	
11-Dec-96	345	16:45		47.705	53.000	47	°	42.3	'		53	°	0.0	'	
11-Dec-96	345	17:15		47.699	52.984	47	°	42.0	'		52	°	59.1	'	
11-Dec-96	345	19:00		47.680	52.985	47	°	40.8	'		52	°	59.1	'	
11-Dec-96	345	19:05		47.670	52.969	47	°	40.2	'		52	°	58.2	'	
11-Dec-96	345	19:50		47.674	53.036	47	°	40.4	'		53	°	2.2	'	
11-Dec-96	345	19:52	*	47.681	53.037	47	°	40.8	'		53	°	2.2	'	
11-Dec-96	345	19:55		47.691	53.037	47	°	41.4	'		53	°	2.2	'	
			*	Interpolated data											
				Note: Data is from OCEANS GPS (not ship DGPS)											

RAFT LOCATIONS (INTERPOLATED)														
Date	Julian Day	Time (UTC)		N	W	N				W				
11-Dec-96	345	13:45	*	47.694	53.073	47	°	41.7	'	53	°	4.4	'	
11-Dec-96	345	14:17	**	47.704	53.041	47	°	42.2	'	53	°	2.5	'	
11-Dec-96	345	15:00	**	47.706	53.035	47	°	42.3	'	53	°	2.1	'	
11-Dec-96	345	15:19	**	47.708	53.025	47	°	42.5	'	53	°	1.5	'	
11-Dec-96	345	15:30	**	47.709	53.026	47	°	42.6	'	53	°	1.6	'	
11-Dec-96	345	15:48	**	47.711	53.028	47	°	42.7	'	53	°	1.7	'	
11-Dec-96	345	16:39		47.705	53.003	47	°	42.3	'	53	°	0.2	'	
11-Dec-96	345	16:45	*	47.705	53.000	47	°	42.3	'	53	°	0.0	'	
11-Dec-96	345	17:15	*	47.699	52.984	47	°	42.0	'	52	°	59.1	'	
11-Dec-96	345	17:50	**	47.690	52.979	47	°	41.4	'	52	°	58.8	'	
11-Dec-96	345	17:55	**	47.689	52.979	47	°	41.3	'	52	°	58.7	'	
11-Dec-96	345	18:13	**	47.684	52.976	47	°	41.0	'	52	°	58.6	'	
11-Dec-96	345	19:00	**	47.672	52.970	47	°	40.3	'	52	°	58.2	'	
11-Dec-96	345	19:03	**	47.671	52.970	47	°	40.2	'	52	°	58.2	'	
11-Dec-96	345	19:05	*	47.670	52.969	47	°	40.2	'	52	°	58.2	'	
11-Dec-96	345	19:50		47.674	53.036	47	°	40.4	'	53	°	2.2	'	
11-Dec-96	345	19:52		47.681	53.037	47	°	40.8	'	53	°	2.2	'	
11-Dec-96	345	19:55		47.691	53.037	47	°	41.4	'	53	°	2.2	'	
			*	CCGS Gilbert deployment and recovery locations										
			**	Calculated by Interpolation using experiment search track and detection log data										

APPENDIX E: DND Northern Field Trials

'GOES' FRINGE AREA TEST

I WOULD LIKE TO THANK 440 (T AND R) SQUADRON FOR ASSISTING CMCC (CANADIAN MISSION CONTROL CENTRE) WITH THIS IMPORTANT TESTING.

BACKGROUND

'GOES 8' AND 'GOES 9' ARE GEOSTATIONARY SATELLITES WHICH FORM PART OF THE SARSAT SYSTEM. THESE SATELLITES HAVE TRANSPONDERS ONBOARD WHICH ARE CAPABLE OF DETECTING 406.025 MHZ EMERGENCY TRANSMISSIONS. THE NEWEST GENERATION 406 MHZ BEACONS ARE BEING EQUIPPED WITH GPS ENCODERS. THESE ENCODERS ARE ABLE TO UP-LINK A GPS POSITION TO BOTH THE 'GOES' SATELLITES AND THE LOW EARTH ORBITING (LEO) SATELLITES.

406 MHZ BEACON

YOU HAVE BEEN PROVIDED WITH A SATFIND 406.025 MHZ EPIRB WITH GPS ENCODING CAPABILITY. THIS UNIT IS MANUFACTURED BY NORTHERN AIRBORNE TECHNOLOGY (NAT) LTD OF KELOWNA BC. THE BEACON TRANSMITS A **'TEST'** CODED SIGNAL WHICH WILL BE AUTOMATICALLY PROCESSED BY THE CMCC COMPUTER. **THE BEACON'S 121.5 HOMER HAS BEEN DISABLED.** THE BEACON HAS A BATTERY LIFE OF APPROXIMATELY 47 HOURS. ****THE UNIT IS VALUED AT $25,000****

NOTE: NORTHERN AIRBORNE TECHNOLOGY HAS ASKED IF PHOTOS COULD BE TAKEN OF THEIR EPIRB WITH SOME ARCTIC SCENERY/LOCATION NAMES ON AIRPORT TERMINALS, ETC IN THE BACKGROUND. IF THIS IS NOT TOO MUCH OF AN IMPOSITION, PLEASE SEND US THE UNDEVELOPED FILM-ROLL OR NEGATIVES, AT ANY TIME THAT IS CONVENIENT. .

PURPOSE OF TEST

UNLIKE THE 'LEO' SATELLITE SYSTEM, WHICH HAS GLOBAL 406 MHZ DETECTION ABILITY, THE 'GOES' SATELLITES HAVE A LIMITED FIELD OF VIEW (SEE ATTACHED MAPS). THE LINES ON THESE MAPS INDICATE THE '0 DEGREE' VISIBILITY (THEORETICAL ABSOLUTE MAX FIELD OF VIEW). WE ARE HOPING TO TEST GOES SIGNAL RECEPTION CAPABILITY FROM BEACONS LOCATED IN THE VICINITY OF THESE LINES.

TEST PROCEDURE

THE TEST PROCEDURE HAS BEEN INCLUDED ON THE 'BEACON ACTIVATION' LOGS WHICH ARE INCLUDED IN THIS PACKAGE. THERE IS NO REQUIREMENT TO CONTACT US PRIOR TO BEACON ACTIVATIONS. IT WOULD BE APPRECIATED IF THE LOG COULD BE FAXED TO CMCC FOLLOWING AN AIRCRAFT'S RETURN TO YELLOWKNIFE (IE WITHIN A FEW DAYS).

A NUMBER OF SUGGESTED TEST SITES ARE INCLUDED (ANNEX A). IF YOU HAVE TRIPS PLANNED TO OTHER SUITABLE LOCATIONS WHICH ARE NOT LISTED, PLEASE FEEL FREE TO CONDUCT TESTS AT THOSE SITES.

OPI FOR THIS PROJECT IS CAPT BLAIR MACARTHUR. HE WILL BE IN TOUCH WITH YOU TO ARRANGE A POC AT 440 (T&R) SQN. ANY QUERIES CAN BE DIRECTED TO HIM AT AV 827-7265 OR MAJ GORDON AV 827-3660.

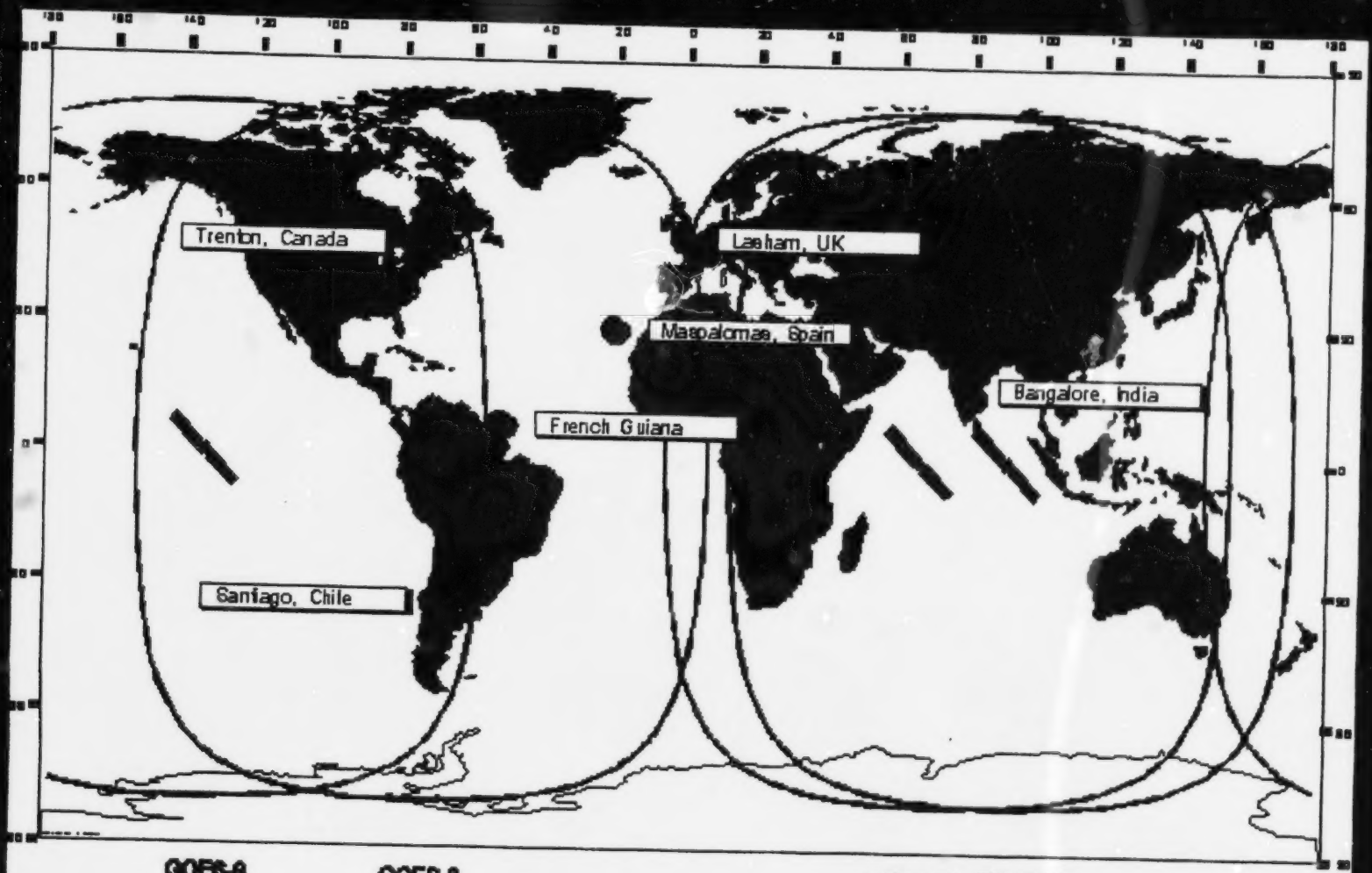
ANNEX A

CAMBRIDGE BAY	SIGNAL CALIBRATION LOCATION	NOTE 1
RESOLUTE BAY	SIGNAL CALIBRATION LOCATION	NOTE 1
EUREKA		
TANQUARY FIORD		
IQALUIT		
PANGNIRTUNG		
POND INLET		
CLYDE RIVER		
GRISE FIORD		
BROUGHTON ISLAND		
SHINGLE POINT		
INUVIK OR TUKTOYUKTUK		
MOULD BAY		
ANY ALASKA LOCATIONS IN VICINITY OF LIMIT LINES		

**NOTE 1: OTHER LOCATIONS WITH SIMILAR LATITUDES MAY BE USED IF YOU ARE UNABLE TO GET TO THESE LOCATIONS.

406 MHZ BEACON - CANADIAN (GOES) FRINGE AREA TEST

DATE	BEACON ON TIME UTC/MINS	LOCATION	SIGNIFICANT TERRAIN	GOES DETECTION	CARRIER/ NOISE RATIO dBM	SIGNAL/ NOISE RATIO dBM	# HITS/ HITS TO EXPECTED ITS RATIO
6 JUN 97	2156-2324/ 88 MINUTES	EUREKA 7959.7N 08548.8W	HILLY TERRAIN TO 2000' MSL	GOES 8 (3165) ONLY	21.1-25.8	27.1-33.0	48/0.5
9 JUN 97	1538-1600/ 22 MINUTES	ALERT 8231.1N 06216.8W	HILLY TERRAIN TO 1000'MSL	NO	N/A	N/A	N/A
9 JUN 97	2053-2110/ 17 MINUTES	TANQUARY FIORD 8124.6N 07652.9W	MOUNTAINOUS TO 4500' MSL	NO	N/A	N/A	N/A
24 JUN 97	2336-2351/ 15 MINUTES	RESOLUTE BAY 7443.0N 09458.2W	NONE	GOES 8 (3165) ONLY	25.0-34.5	31.8-42.5	16/0.95
6 JUL 97	1604-1700/ 56 MINUTES	FORT GOOD HOPE 6614.5N 12839.0W	NONE	GOES 9 (3166) GOES 8 (3165)	23.5-27.2 21.2-31.2	33.7-35.7 29.2-39.0	31/0.49 4/0.06
18 SEP 97	1631-1730/ 59 MINUTES	INUVIK 6818.3N 13329.7W	NONE	GOES 9 (3166) ONLY	27.6-30.0	34.9-37.6	59/1.0



406 MHz Geosar System (April 1997)

0° LIMIT ABSOLUTE MAX RANGE

406.025 MHZ BEACON - (GOES) FRINGE AREA TEST

BEACON ACTIVATION LOG

DATE	LATITUDE/ LONGITUDE (0.1 DECIMAL ACCURACY) & AIRFIELD NAME	SIGNIF. CLOUDS & WEATHER (LOOKING SOUTH)	BEACON ON (UTC)	BEACON OFF (UTC)	SIGNIFICANT TERRAIN OBSTRUCTIONS/ HEIGHT (LOOKING SOUTH)

****THIS BEACON IS A TEST CODED BEACON. THE 121.5 MHZ HOMER SIGNAL HAS BEEN DE-ACTIVATED****

PROCEDURE:

1. SELECT AN AREA AWAY FROM ANY OBSTRUCTIONS. IF OBSTRUCTIONS ARE UNAVOIDABLE ATTEMPT TO GAIN A CLEAR VIEW TO THE SOUTH OF THE BEACON (120 DEGREES - 240 DEGREES TRUE);
2. INDICATE DATE, LOCATION, CLOUDS AND VISIBILITY AND 'BEACON-ON' TIME IN THE ABOVE LOG;
3. NOTE: LEAVE THE BEACON IN IT'S BRACKET (IT IS A MARINE EPIRB AND WILL NOT STAND UP VERY WELL ON IT'S OWN).
4. SELECT BEACON TO **'MANUAL-ON'** BY DEPRESSING THE BLACK BUTTON AND SLIDING IT ONE POSITION TO THE RIGHT. **THE BEACON STROBE LIGHT PULSES EVERY 2-3 SECONDS TO INDICATE ACTIVATION**. SET THE BEACON SO THAT IT IS LAYING BACK ON IT'S MOUNTING BRACKET WITH THE ANTENNA ORIENTED AT A 45 DEGREE ANGLE UPWARDS AND IN A EASTERLY OR WESTERLY DIRECTION;
5. LET BEACON RUN FOR 20 - 30 MINUTES (15 MINUTES IS ABSOLUTE MINIMUM);
6. TURN BEACON OFF - SELECT SWITCH TO **'ARMED'** POSITION;
7. INDICATE 'BEACON OFF' TIME AND ANY REMARKS. PLEASE DON'T LEAVE THE BEACON BEHIND - IT'S WORTH $25,000;
8. ON YOUR RETURN TO YELLOWKNIFE, **FAX THIS PAGE TO CMCC TRENTON** - FAX (AV 827-7190/COMM 613-965-7190) ATTENTION: CAPT MACARTHUR. THANKS FOR YOUR ASSISTANCE!

C:\EPIRB\FRINGE.TST

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                              SEARCHING FOR U406S
MCC QUERY REPORT          DA(   ASE: BASIC                  060(  :00Z98
UMBER OF CASES :     0
UMBER OF EVENTS:     2

 VENT   TCA     F  BIAS S TY C SRC  SAT      LAT       LONG     SRR  PR CL
---- -------- - ----- - -- - ---- ---   ------- -------- ---- -- --
0743 051 2259 4 +00.8 9 EL 3 3163 S06 A 6837.9N 13050.9W TR01 73 PR
                          ST: SUPPRS  B 6301.4N 16214.7W US01 27 SC
F/CC 316/LOC-TEST-STANDARD     /ID  A::                    /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

0720 051 2252 4 +00.6 9 EL 3 3162 S03 A 6901.0N 13114.5W TR01 59 PR
                          ST: SUPPRS  B 7412.5N 10126.4W TR01 41 SC
F/CC 316/LOC-TEST-STANDARD     /ID  A::                    /::/:
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UMBER OF U406S :     2

 4 ID   TCA            SRC    MSGNM    SAT  ORBNM    PTS    STATUS
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0820    051 2316Z98    3163   69438    C06  34830      1    SUPPRS
F/CC 316/LOC-TEST-STANDARD     /ID  A::                    /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/
 PRESS ANY KEY TO CONTINUE
0752    051 2316Z98    3162   49129    C06  34829      1    SUPPRS
F/CC 316/LOC-TEST-STANDARD     /ID  A::                    /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/
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D-7 040 →

059

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EVENT    TCA     F  BIAS S TY C SRC  SAT     LAT      LONG     SRR  PR CL
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 8494 039 1920 4 +00.7 9 EL 3 3161 S03 A 7029.6N 06831.3W TR01 95 PR
                          ST: SUPPRS  B 7213.4N 05846.7W NO01 05 SC
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EX 279C2 70004 00000/LAT 7029.1N/LONG 06831.0W/HS 121/:::/

 8498 039 1914 4 +00.7 9 EL 4 3163 S04 A 7029.6N 06831.4W TR01 58 PR
                          ST: SUPPRS  B 8803.9N 03855.3E RU01 42 SC
F/CC 316/LOC-TEST-STANDARD    /ID  A::                   /::/:
EX 279C2 70004 00000/LAT 7029.1N/LONG 06831.0W/HS 121/:::/

 8685 039 1914 4 +00.7 9 EL 4 3161 S04 A 7029.6N 06831.4W TR01 61 PR
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 F/CC 316/LOC-TEST-STANDARD    /ID  A::                   /::/:
EX 279C2 70004 00000/LAT 7029.1N/LONG 06831.0W/HS 121/:::/

 8484 039 1914 4 +00.7 9 EL 4 3162 S04 A 7029.6N 06831.4W TR01 61 PR
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F/CC 316/LOC-TEST-STANDARD    /ID  A::                   /::/:
EX 279C2 70004 00000/LAT 7029.1N/LONG 06831.0W/HS 121/:::/

 8686 039 1914 4 +00.7 9 EL 3 3161 S04 A 7028.6N 06829.2W TR01 89 PR
                          ST: SUPPRS  B 8743.2N 03109.9E RU01 11 SC
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EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

 8499 039 1914 4 +00.7 9 EL 3 3163 S04 A 7028.6N 06829.2W TR01 89 PR
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 8485 039 1914 4 +00.7 9 EL 3 3162 S04 A 7028.6N 06829.2W TR01 89 PR
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 0510 025 1503 4 +00.5 9 EL 3 3163 S03 A 7241.4N 07756.7W TR01 85 PR
                          ST: SUPPRS  B 8522.8N 14341.0W US02 15 SC
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EX 279C2 70004 00000/LAT 7241.7N/LONG 07757.5W/HS 121/:::/

 0507 025 1503 4 +00.5 9 EL 3 3162 S03 A 7241.7N 07756.8W TR01 95 PR
                          ST: SUPPRS  B 8523.6N 14043.2W TR02 05 SC
F/CC 316/LOC-TEST-STANDARD    /ID  A::                   /::/:
EX 279C2 70004 00000/LAT 7241.7N/LONG 07757.5W/HS 121/:::/

 0503 025 1434 4 +00.1 9 EL 3 3164 C06 A 7241.5N 07759.5W TR01 98 PR
                          ST: SUPPRS  B 6623.5N 13831.1W VI01 02 SC
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 0493 025 1434 4 +00.5 9 EL 3 3163 C06 A 7241.7N 07759.6W TR01 97 PR
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X 279C2 70004 00000/LAT 7245.0N/LONG 07800.0W/HS 121/:::/

 0484 025 1434 4 +00.5 9 EL 3 3161 C06 A 7241.8N 07759.5W TR01 50 PR
                          ST: SUPPRS  B 6549.3N 13845.7W VI01 50 SC
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DAY 18 to DAY 041

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 0773 025 1407 4 +00.1 9 EL 1 3164 C04 A 7243.0N 07803.8W TR01 98 PR
                          ST: SUPPRS  B 6319.1N 17714.6E RU01 02 SC
.F/CC 316/LOC-TEST-STANDARD    /ID  A::                  /::/:
 IEX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

 0803 025 1407 4 +00.5 9 EL 1 3162 C04 A 7243.0N 07803.7W TR01 99 PR
                          ST: SUPPRS  B 6319.1N 17714.6E RU01 01 SC
 F/CC 316/LOC-TEST-STANDARD    /ID  A::                  /::/:
 EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

 0479 025 1407 4 +00.5 9 EL 1 3163 C04 A 7242.7N 07803.5W TR01 99 PR
                          ST: SUPPRS  B 6318.7N 17714.4E RU01 01 SC
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  F/CC 316/LOC-TEST-STANDARD    /ID  A::                  /::/:
 EX 279C2 70004 00000/LAT 7039.0N/LONG 06831.0W/HS 121/:::/
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MCC QUERY REPORT          DATABASE: BASIC                  335 1949Z97
JMBER OF CASES :     0
JMBER OF EVENTS:     8

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                              ST: SUPPRS  B 5452.1N 09114.3W TR01 29 SC
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EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

 7046 316 2310 4 +00.2 9 EL 4 3164 C06 A 4952.6N 11927.8W VI01 93 PR
                              ST: SUPPRS  B 5255.1N 08523.1W TR01 07 SC
F/CC 316/LOC-TEST-STANDARD     /ID  A::                    /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

7042 316 2310 4 -00.3 9 EL 4 3161 C06 A 4952.7N 11927.9W VI01 93 PR
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 F/CC 316/LOC-TEST-STANDARD     /ID  A::                    /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

 7039 316 2309 4 -00.3 9 EL 3 3162 C04 A 4951.6N 11927.3W VI01 99 PR
                              ST: SUPPRS  B 4658.9N 15440.0W US01 01 SC
F/CC 316/LOC-TEST-STANDARD     /ID  A::                    /::/:
 EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

7300 316 2309 4 -00.3 9 EL 3 3163 C04 A 4952.3N 11925.4W VI01 89 PR
                              ST: SUPPRS  B 4648.6N 15425.7W US01 11 SC
 F/CC 316/LOC-TEST-STANDARD     /ID  A::                    /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

 7669 316 2309 4 -00.3 9 EL 3 3162 C04 A 4952.4N 11925.9W VI01 89 PR
                              ST: SUPPRS  B 4648.6N 15425.8W US01 11 SC
F/CC 316/LOC-TEST-STANDARD     /ID  A::                    /::/:
 EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

7251 316 2309 4 -00.3 9 EL 3 3161 C04 A 4952.3N 11925.5W VI01 89 PR
                              ST: SUPPRS  B 4648.5N 15425.7W US01 11 SC
 F/CC 316/LOC-TEST-STANDARD     /ID  A::                    /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

7191 316 2309 4 +00.2 9 EL 3 3164 C04 A 4952.4N 11925.5W VI01 89 PR
 PRESS ANY KEY TO CONTINUE
 /CC 316/LOC-TEST-STANDARD     /ID  A::                    /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/
MBER OF U406S :     0
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/ENT   TCA     F  BIAS S TY C SRC  SAT     LAT      LONG     SRR  PR CL
--- -------- - ----- - -- - ---- ---   ------- --------   --  -- --
3852 302 1706 4 +00.5 9 E    3164 S04 A 4952.7N 11927.3W  .01 99 PR
                        ST: SUPPRS  B 5150.1N 12929.4W VI01 01 SC
/CC 316/LOC-TEST-STANDARD    /ID  A::                  /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

3820 302 1706 4 +00.1 9 EL 3 3161 S04 A 4952.9N 11927.7W VI01 98 PR
                        ST: SUPPRS  B 5150.2N 12928.9W VI01 02 SC
F/CC 316/LOC-TEST-STANDARD    /ID  A::                  /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

3704 302 1706 4 +00.1 9 EL 3 3163 S04 A 4953.0N 11927.8W VI01 98 PR
                        ST: SUPPRS  B 5150.2N 12928.8W VI01 02 SC
/CC 316/LOC-TEST-STANDARD    /ID  A::                  /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

3170 301 2211 4 +04.8 9 EL 4 3163 S06 A 4953.3N 11925.6W VI01 96 PR
                        ST: SUPPRS  B 4700.5N 13420.6W US01 04 SC
F/CC 316/LOC-TEST-STANDARD    /ID  A::                  /::/:
X 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

2416 300 2222 4 +04.8 9 EL 4 3163 S06 A 4953.1N 11925.5W VI01 88 PR
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/CC 316/LOC-TEST-STANDARD    /ID  A::                  /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/
MBER OF U406S :    4

4 ID   TCA           SRC   MSGNM   SAT  ORBNM   PTS   STATUS
---   -----------   ----  -----   ---  -----   ---   ------
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F/CC 316/LOC-TEST-STANDARD    /ID  A::                  /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

5495   301 2307Z97   3164  38854   C04  41724     2   SUPPRS
F/CC 316/LOC-TEST-STANDARD    /ID  A::                  /::/:
X 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/

5486   301 2307Z97   3162  32083   C04  41723     2   SUPPRS
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 PRESS ANY KEY TO CONTINUE
5482   301 2307Z97   3161  50517   C04  41722     2   SUPPRS
/CC 316/LOC-TEST-STANDARD    /ID  A::                  /::/:
EX 279C2 70004 00000/LAT12700.0N/LONG 25500.0E/HS 121/:::/
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